CARNIVOROUS PLANT NEWSLETTER

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CO-EDITORS: D.E. SCHNELL, RT. 4, BOX 275B, STATESVILLE, NC 28677, USA
J.A. MAZRIMAS, 329 HELEN WAY, LIVERMORE, CA 94550, USA

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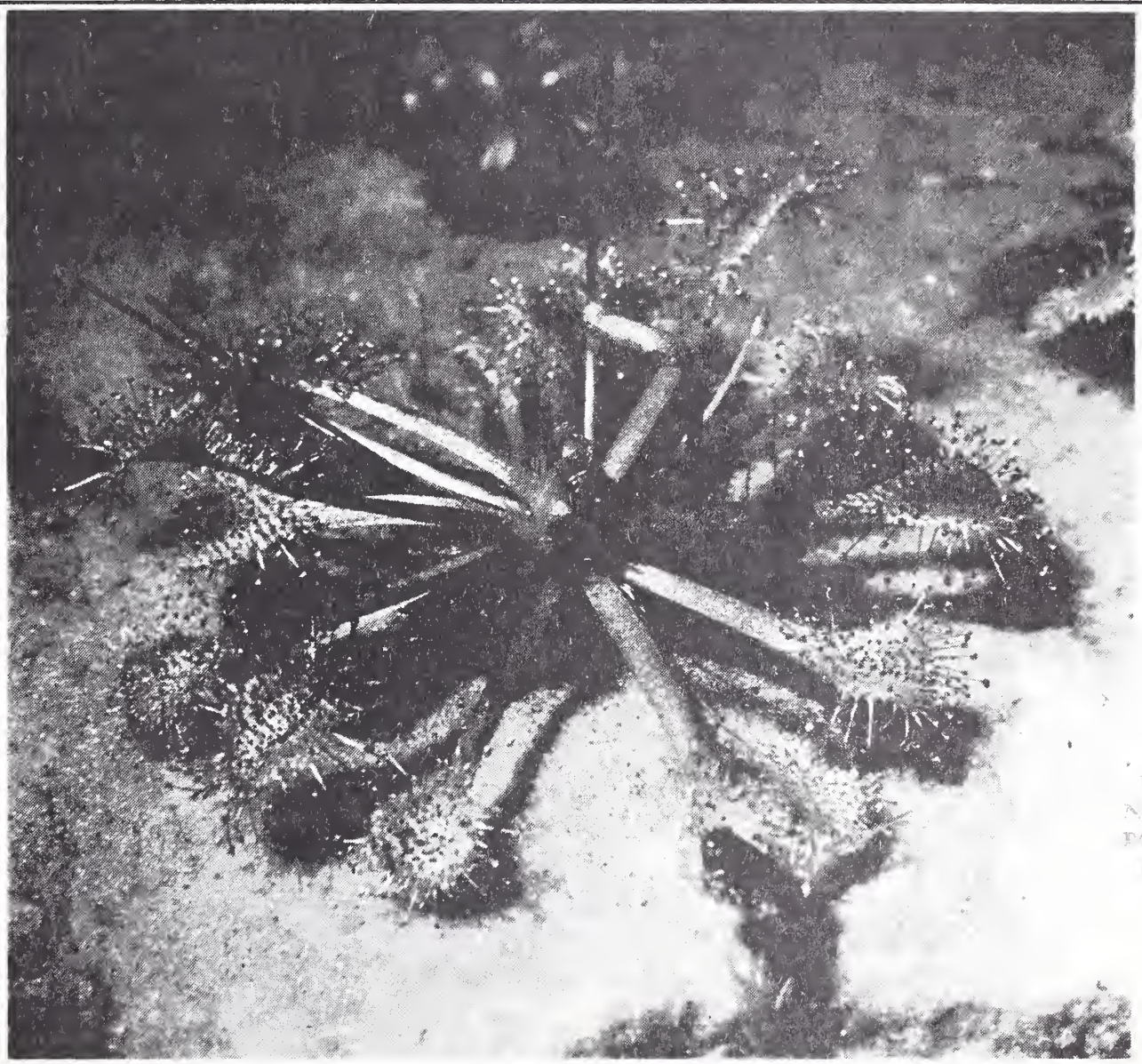
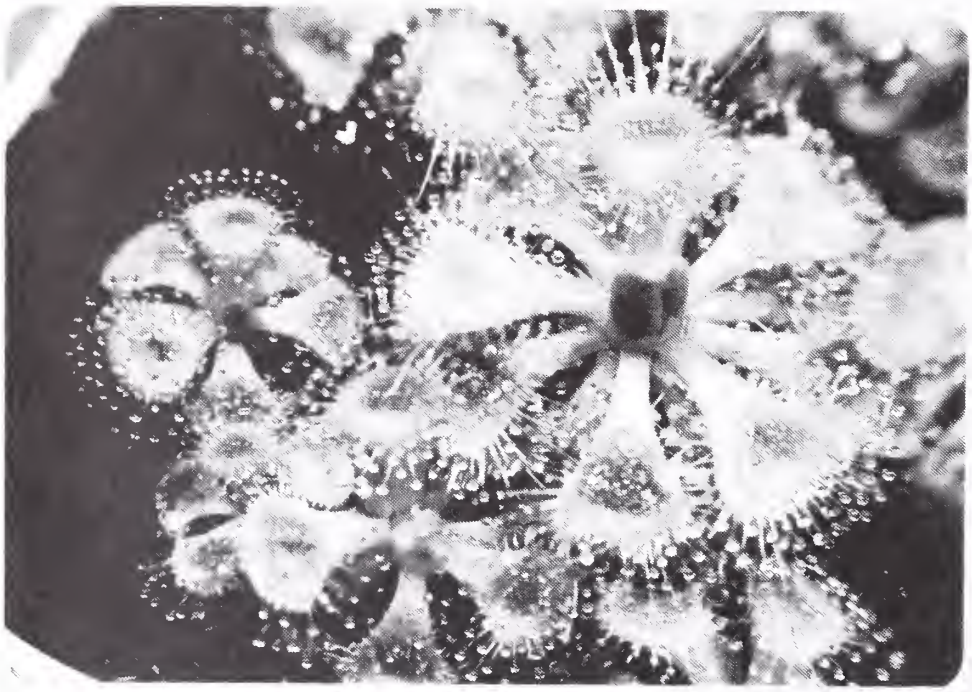


PHOTO BY ROBERT FOLKERTS

DROSERA CAPILLARIS



DROSERA
BURMANNII

DROSERA PULCHELLA
(note the bifid leaf bud on the right.)

PHOTOS ON THIS PAGE
BY STEVE KAPA

DROSERA AURICULATA

NEW SUBSCRIBERS

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ELAINE RINDNER (68-02 Clyde St., Forest Hills, NY 11375).
RICHARD A. MEIXNER (1449 Northland, Lakewood, OH 44107).
ELIZABETH KANE (Route 6, Box 51, Mechanicsville, VA 23111).
ROBERT MICHALOVIC (8008 Grand Avenue, North Bergen, NJ 07047).
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M.J. COHEN (3814 Paseo Navarra, West Palm Beach, FL 33405).
DIRK DOVERSPIKE (Walsh College, Box 78, 2020 Easton Street, Canton, OH 44720).
R.C. SANZI (12513 Longview, Detroit, Mich. 48213).
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MIKE ZANN (4644 N. 23rd Avenue, Phoenix, AZ 85023).
LEONARD WM. HEFLICH (705 Clinton Avenue, Westwood, NJ 07675).
ROBERT CZERWONY (574-C Corkhill Road #319, Bedford, OH 44146) is very interested in hearing from anyone culturing Cephalotus and Nepenthes ampullaria.
GEORGE KELLER (90-19 169th Street, Jamaica, NY 11432).
TOM E. JOHNSON (7638 Wilcox, Forest Park, IL 60130).
DORIS WEST (1132 Michigan, Ann Arbor, Mich. 48104).
MRS. EASTWOOD G. TURLINGTON (1424 Woodland Drive, Rochester, Minn. 55901).
EDWARD W. MALLEY, JR. (100 Research Road, Hingham, Mass 02043).
JAMES W. ALLEN (11038 Saffold Way, Reston, VA 22090).
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D. HOWARD MILES (Drawer CH, Mississippi State, Miss. 39762).
T. BROKENBRO (37 Laburnham Gardens, Upminster, Essex, UK).
MALCOLM F. UHL, JR. (1752 Swenburne Road, Crofton, MD 21113).
TED MORRISON (81 Fir, Park Forest, IL 60466).
DR. MICHAEL VUOCOLO (3791 Kensington Ct., Decatur, GA 30032).
RONALD R. SHURR (1026 Pine Street, Apt. 1, Conway, SC 29526).
T. PATRICK DWYER (49 Killean Park, Albany, NY 12205).
ANTHONY HILL (885 West End Avenue, New York City, NY 10025).
ENID A. FERGUSON (Route 3, Box 29, Pound Ridge, NY 10576).
JAMES TARLETON MORGAN (15 Sumner Avenue, Roslindale, Mass. 02131).
IAN E. M. DONOVAN (405 Lamp Post Drive, Chesapeake, VA 23325).
CHARLES LATORRE (581 Broad Street, Glen Rock, NJ 07452).
C. E. STEPHENSON (2109 Milton Road, Perry, Mich. 48872).
ALBERT STEVES, V (507 Terrell Road, San Antonio, TX 78209).
GLENN BEARDSLEY (12968 Aquilla Road, Chardon, OH 44024).
JIM CHESTER (410 East Aspen Street, Bozeman, Mont. 59715).
RICHARD W. LUTZ (414 Garden Street, Iowa City, Iowa 52240).
DONALD HOTH (6141 W. 55th Street, Chicago, IL 60638).
JANE T. ROWLAND (1339 Winter Street, Augusta, GA 30904).
MRS. OTIS M. HILL (110 Gleaton Street, Sumter, SC 29150).
DAVID G. THOMPSON (217 Bessey Hall, Department of Botany, Iowa State Univ., Ames, Iowa 50010).
FRED CAMPER (350 East 92nd Street, New York City, NY 10028).
MRS. A. W. COUTURE (60 Summer Street, Ashland, Mass. 01721).
MARY ELDERGILL (320 Pebblebrook, 82 Brittany Farms Road, New Britain, Conn. 06053).
WILLIAM A. JOHNSON (308 Pittman Street, Fairmont, NC 28340).
THOMAS A. MARTZ (4711 Emerson Avenue, S., St. Petersburg, FL 33711).
ROBERT E. MOELLER (Ecology and Systematics, 219 Langmuir Lab, Cornell University, Ithaca, NY 14850).

CHANGE OF ADDRESS

LYNN MACEY (511 N. Eby, McPherson, KS 67460).
JOE ISLEY (Box 2774 Duke Hospital, Durham, NC 27710).

NEWS AND VIEWS

For those who are fortunate enough to have access to Drosera linearis but not to the marly soil it apparently requires (further research is being done on this subject), JOE MAZRIMAS reports that he is able to grow the species quite easily on a mixture of vermiculite and sand, apparently without added dolomite or limewater, although further trial with these added components is a possibility. Note that he specifies vermiculite; perlite cannot be substituted. Besides the fact that it works, a priori, we know that the marl soil of a good healthy bog of such type in Canada has a soft aggregate structure of easily crushed 0.5 - 3.0 mm. particles of mixed fine clay, sand and lime, much the same

physical character as a mix of vermiculite and sand produces. Furthermore, vermiculite has a high aluminum content similar to clay. Joe supplements the cultures with regular dilute fertilizer treatments as he has outlined previously for us (CPN III, p. 29) and provides "winter" dormancy conditions through refrigeration.

THE CO-EDITORS would like to welcome all new subscribers, and welcome back those who have renewed. We remind you that all CPN subscribers are eligible for the CPN Plant and Seed Exchange Program very ably run by volunteer Bob Ziemer (840 Fickle Hill Road, Arcata, CA 95521). All you have to do to join is write Bob and enclose: (1) A list of plants you are growing; (2) 50¢ or more donation to help Bob with the terrific postage involved in his exchange work; (3) indicate on your plant list any plants or seeds thereof you have to trade (but you need not have anything to trade to join). Anyone with excess seed is invited to send it to Bob for distribution. You will receive the computer printouts of the same information everyone else has sent in, organized in a very fine and efficient manner, about twice a year. We ask that you not abuse the program and ONLY write those individuals on the computer printout who indicate that they have plants to trade of a species you want; do not write growers of plants unless they have indicated willingness to exchange, and these people will be appropriately marked on the printout. We suggest you include or at least offer postage (min. $1.00) to prospective traders. If anyone feels they have been unfairly treated in a trade, or if the other person did not properly reciprocate, send your complaint to Bob. Three such complaints will result in considering removal of that person from the exchange.

New subscriber DORIS WEST has been an indoor light enthusiast for years and has just recently started working with CP, smaller plants such as Dionaea and Drosera. She uses moss and a triple bank of 48" (40W) fluorescent lights: one warm white, one deluxe cool white and one Vitalite, one-half inch from the plants in a mostly covered globe. The co-editors have good reason to believe that many of our subscribers are interested in indoor light growing and likely some have excellent experience that should be shared with the group.

JOE MAZRIMAS reports that he viewed the new film, THE TENDER TRAP, a 53-minute production by the famous Oxford Science Films group (some of their fine work has been seen on British TV and on PBS-ETV stations on the U.S.). The film, of course, deals with CP and presents some remarkable photography with some unusual views. His main criticisms were a rather hoary initial scene with an ancient mantrap, an occasional tendency towards Disneyesque cuteness with music and rhythms, and not clarifying what was time lapse photography and normal fps. He did note that the fantastic speed of 300 fps failed to arrest the closure of a Utricularia trapdoor, and some actual sound effects turned up through sonic magnification. For those interested, the film rents for $50 a single showing, or can be purchased in either Eastmancolor or Ektachrome for 200 and 250 pounds sterling, respectively. Write for further information: Oxford Scientific Films Ltd., Lower Road, Long Hanborough, Oxford OX7 2LD, England. There is a possibility, in fact a likelihood, that the film may turn up on PBS-ETV in the U.S. in the NOVA series, so watch for it.

On page 45 of the preceding Volume III, we mistakenly referred to PATRICE MORROW as "he" and she is actually a "she." We apologize for the oversight.

STEVE KAPA writes in to tell us of a good way to guarantee germination of Drosophyllum seed. He soaks it in hot water. "In the first experiment," he writes, "I poured hot water into a dish and dropped in nine seeds when the temperature was 170°F. They cooled and soaked overnight, as did the control group which only soaked in unheated water. Both groups were sown in the same jar, lightly pressed into sand-peat to make good contact. The jar sat outside in the open shade with temperatures from 45°F. to 70°F. In four weeks, eight of the heated seeds germinated, but only one in the cool control group was up."

CARL FORST sends us a clipping from the Los Angeles Times newspaper and specifically from the Home Magazine section dated November 3, 1974. The article is titled "Those Captivating Carnivores" by Dan MacMasters. In it the author discusses CP in general terms but photographs of the various plants are from Sam Potter's collection. Carl also would like to announce a recent change in the price of the catalog from Aqua Engineers, 250 Cedar Street, Ortonville, Mich. 48462. In the last issue of CPN, he recorded a price of 25¢, but that has been recently changed to 50¢. The catalog lists sources of microworms and vinegar eels for those who are growing Utricularia and Aldrovanda.

JIM ORAVETZ writes: "First, let me say thank you for a wonderful year of CPNewsletter. They were just great! I hope to see many more. I like the idea of the member poll. Perhaps two a year would help you keep on top of what the members feel about the organization and its goals. Here are two more of my ideas. Send a questionnaire to each member of perhaps a year or more, asking how they got started--a brief history in CP, the type of growing equipment, list of plants including material available for trade or to give to a new member to help them get started. Also, request two photos: one of the member in or by his greenhouse or terrarium, and one picture of his "prize plant." Also requested would be growing tips, hints, secrets, etc. Take all this information and write up a short article fitting one page in the newsletter. This would provide a tremendous amount of information for the beginner."

BRUCE HOGARD tells how he grows Darlingtonia and Nepenthes: "Both of these plants are grown in five gallon pickle jars in the east window of my apartment. They are planted in peat moss. First, I add about a two-inch layer of charcoal for drainage and follow this with peat moss which I treat in the following way. I boil a nice size pot of distilled water and while it is still at full boil, I add peat to it and stir while continuously adding more until it becomes a thick mud. What this does is to wet the unusually dry peat which is sold that way. The boiling water also helps to kill a lot of nasty things that may kill the plant. With these two plants you need nothing to help kill them. After the peat is so thick that you can no longer stir it, cover the pot and let it sit for one half hour. Next, add some cold water to help cool it. When you can stick your hand in it without screaming, it is cool enough to take the excess water out by pressing paper towels on top of the peat and tipping the pot to pour the water out. Do this until the peat is moist but NOT WET! Cover the charcoal in the jar with about a three-inch layer of peat. Next, insert the plants and cover the top of the peat with some sphagnum moss or other ground cover. Then cover your pickle jar with the lid and set it in the east facing window or in a bright room or under artificial lights. Since the peat is warm, your jar has lots of humidity in it and the plants are off to a happy start. Under this system, my Darlingtonia have been thriving for two years and my Nepenthes have been growing well. Since last May, I have four Nepenthes in one jar and they seem very happy there. They bear nicely formed leaves with beautiful pitchers. I do recommend this method for growing both these plants. The jar is eighteen inches high and ten inches wide."

Several subscribers have asked about botanical dictionaries. Good dictionaries that are still in print are quite few, but we suggest the following:

Jackson, BD. A glossary of botanic terms, Duckworth--London, last printing 1971, 481 pages. (Available in U.S. from Hafner Publishing Company, 866 Third Avenue, New York City 10022). Very complete.

Debenham, CN. The language of botany. Published by Society for Growing Australian Plants (no date), 64 pages. (Obtain from editor: W.H. Payne, 860 Henry Lawson Drive, Picnic Point, NSW 2213, Australia. $2.50 postpaid). An excellent little glossary.

In addition to a dictionary, we would suggest that all of our younger botanist subscribers purchase a good general text of botany, college level. There are many good texts available, and these can be found in college book stores (anyone can get in and buy books) and sometimes in large city book shops. You may also consult your local public or school library, look over the botany books there for suitability, and then write the publisher for a copy. Do NOT buy a general botany text that looks "brief and simple"--remember, it is for reference and you will rapidly outgrow a text that is too introductory.

Several people have written about illustration acknowledgments. All cover drawings are acknowledged with the artist's name immediately beneath the drawing, in it, or mentioned in the description. All cover photos are similarly acknowledged except those submitted by co-editor Don Schnell. The little spacer drawings that show up from time to time are Dave Kutt's unless otherwise mentioned. All illustrations within the newsletter are understood to be the product of the author of the article to which they pertain; exceptions are acknowledged.

We are offering an update of the annual list of carnivorous plant commercial sources. It is our experience that spring is the best season to order these plants and winter is the poorest time for quality plants. If you know of any other places with significant lists, please let us know. We do not editorially endorse any of these sources.

SOME COMMERCIAL SOURCES OF CARNIVOROUS PLANTS

Name and Address	Catalogue	Genera
Peter Pauls Nurseries Darcey Road Canandaigua, New York 14424	25¢	Dionaea, Drosera, Sarracenia, Pinguicula, Darlingtonia, Utricularia, Nepenthes seed.
Armstrong Associates, Inc. Box 94H Kennebunk, Maine 04043	25¢	Dionaea, Drosera, Sarracenia, Pinguicula, Darlingtonia
Sun Dew Environments P. O. Box 503 Kenmore Station Boston, Mass. 02215	Self-addressed, stamped envelope	Dionaea, Drosera, Sarracenia, Pinguicula, Darlingtonia, Utricularia
Arthur E. Allgrove North Wilmington, Mass. 01887	25¢	Dionaea, Sarracenia, Pinguicula, Darlingtonia, Drosera

Insectivorous Botanical Garden 1918 Market Street P. O. Box 3322 Wilmington, North Carolina 28403	25¢	Dionaea, Drosera, Sarracenia, Darlingtonia, Pinguicula
International Growers Exchange P. O. Box 397 Farmington, Michigan 48024	$2.00 (deductible)	Dionaea, Drosera, Sarracenia, Pinguicula, Darlingtonia
Peter and Pam P. O. Box 4415 San Fernando, California 91342	Free	Darlingtonia, Dionaea
Tote Em in Zoo Route 2, Box 368 Wilmington, North Carolina 28401	Free list	Dionaea, Drosera, Sarracenia, Pinguicula
Insectivorous Plant Environments 26381 Whitman Street Hayward, California 94544	Free	Dionaea, Drosera, Pinguicula, Darlingtonia, Sarracenia
Marcel Lecoufle 5 Rue de Paris 94470 Boissy-Saint-Leger, France	Inquire	Nepenthes plants (write for latest list of species)

RESULTS OF THE FIRST CPN POLL (1974)*

		PERCENT		
		YES	NO	BLANK
1.	Satisfied with CPN content?	81.3	11.7	7.1
2.	"Short Notes" copyrighted?	44.1	33.3	22.5
3.	Organized society?	51.8	38.4	9.8
4.	Financial requirement?	53.6	19.6	26.8
5.	Quotable botanical source?	78.6	15.2	6.3
6.	Increase number of issues?	69.6	24.1	6.3
7.	Rate commercial CP places?	80.3	15.2	4.5
8.	Send poll on commercial places?	60.2	25.7	14.2
9.	See regional maps?	76.8	18.8	4.5
10.	Give location details?	66.1	20.5	13.4
11.	Slide lending library	75.2	11.5	13.3
12.	Type of pictures? Plant-35.6 Flower-12.1 Field pictures-35.6 Cultivated plants-16.7			
13.	Book library?	64.3	28.6	7.1
14.	Compulsory communication	25.0	67.9	7.1

*This poll is based on the results of 112 returns out of 313 sent out.

SHORT COMMENTS

COMMENTS ON QUESTION 1

SEE MORE:
1. Emphasis on conservation areas and collecting restraints.
2. Photos of better quality (Done-Dec.,1974)
3. Keys for identification
4. Cultivation and propagation techniques
5. General or summary material
6. Taxonomy and pollination
7. Articles translated from Japanese books
8. Articles for the non-professional grower
9. Personal explorations of plant habitats
10. Information of where to obtain plants and more about companion plants
11. Data on individual species-habitat, locations and descriptions
12. Potting of different varieties
13. Personal letters published
14. Indoor growing under lights, artificial feeding and culture methods
15. Accounts of field observations while natural populations still exist
16. Methods of propagation
17. List of all known members not just new (Done-Dec., 1974)
18. More emphasis on basic vocabulary for beginners

SEE LESS:
1. Drawings
2. Technical information
3. Taxonomy
4. Scientific type articles
5. Photos of poor quality
6. Complicated scientific talk
7. Technical details that most members may not be able to relate to

COMMENTS ON QUESTION 2

1. No specific "wish" on this but I would suggest that if copyright is undertaken, reproduction be permitted if the source is fully credited.
2. Copyrights aren't worth the paper they're written on.

COMMENTS ON QUESTION 3

1. An editorial board should be added.
2. Probably would lose many amateurs and lay persons.
3. I believe that CPN should, above all, strive to have support from both professional biologists and amateurs, a loss of either would be criminal towards the CPN.

COMMENTS ON QUESTION 5

1. Too restrictive for the news of non-botanists. But a reasonable set of standards is necessary to allow most of the membership to respond.
2. It is not preferred.

COMMENTS ON QUESTION 6

1. Yes, if sufficient literature comes in; otherwise we will get repetition and eventual drop on subscribers.
2. If enough material is available.

(TO BE CONTINUED IN NEXT ISSUE)

SPECIAL NOTICES

KING'S PARK BOTANICAL GARDENS in Australia has announced that they will no longer supply or sell seed to private individuals. Please do not write them for seed information or seed lists. Quite frankly, they have been forced to this position because of abuse of their offer to sell seed lists and seed to individuals over the years. This has created an overload in correspondence to handle, and they have had to return money to many who did not inquire about what was available before sending orders. From now on, they will deal only through recognized botanical gardens.

Peter Pauls Nursery (Canandaigua, NY 14424) sent a note that they have several plants of Drosera capensis x D. anglica hybrid for sale at $3.50 each postpaid, available in March.

Please note that Carolina Insectivorous Plants is no longer in our list of commercial sources. Ted Minton has informed us that he has gone wholesale only and is not presently in retail sales.

Co-editor JOE MAZRIMAS is in the market for undamaged back issues of CPN and will buy them at their original price. Perhaps a reader knows of someone who has dropped out of CPN and would like to get rid of his back issues. Also, Joe is interested in purchasing used copies of the well known and out of print books Plants of Prey (by Rica Erickson) and Lloyd's classic Carnivorous Plants. Many readers have also inquired about these books, and we are sorry that we have nothing to offer. There are unconfirmed rumors of a new printing or new upcoming edition of the Erickson book, but it has not appeared. In the meantime, your best bet is to scour all the used bookstores and mail-order houses specializing in natural history. There were a great number of both these books printed and we cannot imagine where they all are considering the relatively few people pursuing the study of CP with any intensity.

NEWS ABOUT BACK ISSUES: As many older subscribers and too many new ones know, we exhausted our supply of back issues long ago. At this time, the co-editors do not contemplate a reprinting since this would involve a relatively small number of each issue and would therefore be quite expensive. Besides, we would have on hand a deficit inventory of back issues until they were all sold, a speculative business at best, and we would prefer to keep any sales beyond actual new issues of CPN to the few popular offprints and some books mentioned later in this issue in the "Shop" section. However, one of our subscribers has offered to have back issues reprinted as his own private enterprise. This enterprise has nothing officially to do with CPN or the co-editors, but he has our permission. Orders and payments should be sent directly to him. As you know, we have three volumes, or twelve issues distributed, and particulars on ordering back copies are as follows: Prices--(ALL are postpaid, surface) $6.00 per volume (4 issues) U.S., Canada and Mexico, $7.00 per volume overseas. For those desiring single issues for one reason or another, they are $2.00 each U.S., Canada and Mexico, $2.25 each overseas. Send all orders accompanied by payment to: A. Roger Kirby, Route 3, Box 470, Granite Falls, N. C. 28630.

THE PINGUICULA SPECIES OF THE TEMPERATE GROWTH TYPE AND THEIR CULTIVATION

by Jürg F. Steiger

1. The two growth types of Pinguicula

There are two kinds of annual growth cycles in the genus Pinguicula - the tropical growth type and the temperate growth type (3). As shown in the upper part of fig. 1), the temperate growth type species are forming a winter bud (hibernaculum) each year at the end of the summer period. Such a stage is absent in the tropical growth type, where photosynthesis is also maintained during the cold season and where some species even have two flower periods annually (e.g. P. moranensis).
In both growth types the cycle generally begins with a first set of leaves followed by the flower (generative rosette). A second set of leaves is then developed during or after the seed stage (vegetative rosette). In the majority of species the shape and size of the leaves of the generative and vegetative rosettes are identical (homophyllous type - 33 species). In other species however the two rosettes are different (heterophyllous type - 15 species) and this heterophyllism is also present among 3 of the 14 hibernaculum-forming species. A growth type classification of the 48 Pinguicula species known today is given in fig. 1).

	TROPICAL GROWTH TYPE (34 SPECIES)	TEMPERATE GROWTH TYPE (14 SPECIES)
spring	generative rosette	generative rosette
summer	flower	flower
autumn	vegetative rosette	vegetative rosette
winter	flower	hibernaculum
spring	generative rosette	generative rosette
	etc.	etc.
HOMOPHYLLOUS GROWTH TYPE Leaves of the generative and vegetative rosettes are of the same shape and size	TROPICAL-HOMOPHYLLOUS GROWTH TYPE P. agnata, P. albida, P. antarctica, P. benedicta, P. caerulea, P. calyptrata, P. chilensis, P. cladophila, P. crenatiloba, P. crystallina, P. filifolia, P. hirtiflora, P. involuta, P. ionantha, P. jackii, P. lignicola, P. lilacina, P. lusitanica, P. lutea, P. planifolia, P. primuliflora, P. pumila	TEMPERATE-HOMOPHYLLOUS GROWTH TYPE P. algida, P. alpina, P. corsica, P. grandiflora, P. leptoceras, P. macroceras, P. nevadensis, P. ramosa, P. variegata, P. villosa, P. vulgaris
HETEROPHYLLOUS GROWTH TYPE Leaves of generative and vegetative rosettes are of different shape and size	TROPICAL-HETEROPHYLLOUS GROWTH TYPE P. acuminata, P. colimensis, P. cyclosecta, P. elongata, P. gypsicola, P. heterophylla, P. imitatrix, P. kondoi, P. macrophylla, P. moranensis, P. oblongilcba, P. parvifoiia	TEMPERATE-HETEROPHYLLOUS GROWTH TYPE P. balcanica, P. longifolia, P. vallisneriifolia

Fig. 1) Growth type classification in the genus Pinguicula (3,5,14)

2. Some general remarks on the temperate growth type species

Tropical growth type species are generally more popular among botanical gardens as well as among private growers than the temperate ones. Some tropical species (e.g. P. moranensis, P. gypsicola) are indeed very easy to cultivate in comparison to most temperate growth type species. This seems

somewhat paradox as one could argue that the temperate species are in dormancy for 4-8 months each year and have to be cared for only during the vegetation period in the remaining months while the evergreen species need uninterrupted care all the year through. Quantitatively this is true but the problems are mainly on the qualitative side - during their short vegetation period most of the temperate growth type species need highly specific growing conditions which are not easily reproducable in the usual kind of greenhouses unless an efficient cooling system is installed (see chapter 4). A further vital precondition for all northern species is sufficient soil moisture and air humidity. But also the hibernaculum stage is a very delicate one - up to now I have probably lost more material in the winter stage than during summer.

As no comprehensive literature on cultivation of northern Pinguiculas is available it may be useful to communicate some details referring to natural and artificial growth condidions. The following remarks are based upon the author's field studies and indoor experiments with Pinguiculas over many years. Up to the present successful cultivation is carried out since 3-18 years with 10 of the 14 temperate growth type species. Scanty material was also obtained of the remaining 4 species, but it either arrived in bad condition or cultivation was not yet successful to an extent which would allow sufficiantly valid comments (P. algida, P. balcanica, P. ramosa, P. variegata). For supplementary information climate maps, habitat descriptions, distribution maps and other literature data were consulted. Most helpful were some observations reported to me by epistolary communications.

The temperate growth type Pinguicula species are restricted to the northern hemisphere between 25°N (Himalaya, P. alpina) and 73°N (Greenland, P. vulgaris). Their vertical amplitude reaches from sea level (mostly arctic habitats: P. algida, alpina, macroceras , variegata, villosa and vulgaris) up to 4100 m = 13'450 f (P. alpina, Himalaya). P. nevadensis mounts up to 3200m = 10'500f (Sierra Nevada, Spain) and P. leptoceras to 3000m = 9840f (Swiss Alps)(3).

The diagram in fig. 2) shows an approximation of the preferred climate range for each species on the basis of their vertical amplitudes and north-south distribution (1-4,6,8-22 and 24-28). Certainly this diagram would discriminate more between different species by the addition of a third dimension indicating different general climate types (atlantic-pacific, mediterranean, continental etc.), as e.g. the arctic circle climate at the Norwegian coast is rather different from the arctic circle climate in central Siberia. Nevertheless the graph makes clear that e.g. P. nevadensis grows in much cooler conditions than P. vallisneriifolia, in relatively shorter summer day length than P. villosa and in a much narrower climate range than P. alpina, macroceras, vulgaris and others.

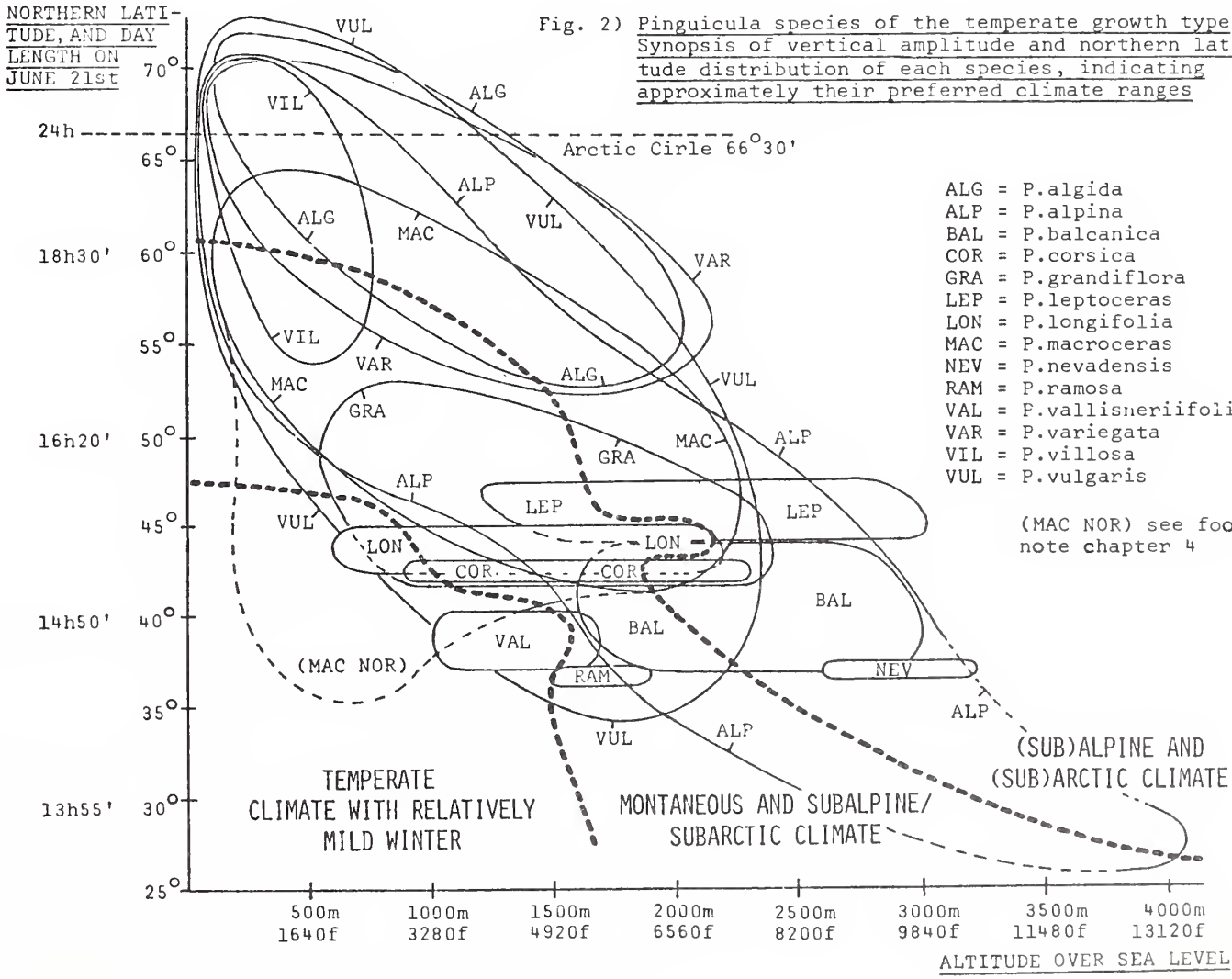


Fig. 2) Pinguicula species of the temperate growth type: Synopsis of vertical amplitude and northern latitude distribution of each species, indicating approximately their preferred climate ranges

3. The seasonal growth cycle

○ WINTER: All 14 temperate growth type species hibernate by means of a winter bud (hibernaculum). The smallest buds are found in P. villosa (diameter 2mm, length 6mm), the largest ones in P. vallisneriifolia (diameter 15-20mm, length 20-30mm). Fig. 4) shows a rosette of P. vulgaris in autumn with the hibernaculum already developed in the center (23). After the first frosts the leaves decay. In 12 species also the roots die in winter. Only in P. alpina and P. variegata (?) the roots are perennial(3). In some species little vegetative brood buds (gemmae) are formed with a length of about 2mm. Such gemmae are particularly numerous - up to 50 per specimen - in P. grandiflora (7) and P. corsica. I have observed several times at natural habitats of P. vulgaris that their winter buds were eaten by mice or snails, but some of the gemmae remained at place and formed new plantlets in spring. Winter buds of unusually large size often stem from specimen infected by Ustilago Pinguiculae. P. vallisneriifolia does not form gemmae but runners. Their connexions with the mother plant generally decay in winter.
Of great importance for the survival of the winter buds is the temperature. All 14 species grow at habitats with winter air temperatures occasionally or constantly below the freezing point. But for successful hibernation of Pinguicula it is vital to know that the winter soil temperatures are generally just at the freezing point or only very slightly below or above it, even if air temperatures are much below it. This is at least true for all habitats insulated by a thick layer of snow - only at habitats in northern continental climates the soil temperature may fall rather far below the freezing point (NE Siberia, NW Canada). Winter buds are frost resistant, but repeated freezing and thawing generally causes their death. In areas with frequent discontinuous autumn and spring frosts Pinguiculas therefore prefer microclimatic niches with smaller daily temperature oscillations. During the dormancy stage the soil substrate should be kept just damp, not soggy.
In room temperature the winter buds perish.

○ SPRING: When the snow has melted away or after the last frosts the new roots and a new rosette of leaves begin to develop out of the hibernaculum. Later on the same process begins with the gemmae, but under the leaves of the already developed large mother plant the majority of the tiny adventive pantlets are not viable, probably due to lack of light. In P. vallisneriifolia the 'gemmae' of the small runner off-shoots germinate in some distance (3-10cm) from the mother plant.
For propagation the gemmae may be removed from the hibernaculum and planted out separately.
If by any reason collection of Pinguiculas was not possible in autumn (see below), material may also be collected in spring, preferably before the rosettes are fully spread out.

○ SUMMER: All discussed species like moderate or cool summer temperatures with a relative air humidity of 60-100%. The required microclimatic conditions are rather specific for each species. The worst physical enemies for northern Pinguiculas are heat and dryness of soil and air. For some species a room temperature of 20°C (68°F) is already much to warm. It is better to keep Pinguiculas to shady than to sunny.
After the flower period the roots loose their ability of regeneration. Therefore mailing of these species is not recommended in summer unless plants are dug out together with enough surrounding substrate. The gemmae begin to develop already in summer. They originate in the axils of the outer leaves of the rosette.
Some species do not grow at places exposed to direct rainfall, while others are not delicate at all in this respect. To simulate the dew or fog of the natural habitat it is recommended to spray the plants each night very slightly with distilled water. Use spray nozzle producing very fine mist.
All species are occasionally or frequently exposed to wind.
Biological enemies of Pinguiculas are: snails, aphids and Ustilago Pinguiculae. Specimen infected by Ustilago (pollen violet instead of yellowish) shoud be thrown away. To avoid aphids substrate surface and leaves may be sprayed with an insecticide containing e.g. Rotenon, Pyrethrum and Piperonylbutoxide. Surprisingly Pinguiculas endure such treatment.
Foliar feeding: Twice a year the leaves are sprayed with a well shaked mixture of 40% white of an egg and 60% water.

○ AUTUMN: In autumn the winter bud begins to develop in the center of the rosette (fig. 4). In adult plants this process starts earlier than in young ones. In P. grandiflora the translation of the rosette into a hibernaculum was found to be induced by the combined effect of shortening days and falling night temperatures (7). Presumably this is true also for other species of the temperate growth type. I have experienced in different species that no winter buds are developed if plants are kept to warm in late summer and autumn. In this case the rosette continuously produces new leaves of increasingly smaller size for some weeks and then suddenly perishes.
Autumn is the best time for collecting and mailing temperate growth type Pinguiculas. The easiest way is to collect them in the beginning decay stage of the leaves. At that time it is still well possible to identify the rosettes among other mouldering plants, but the winter buds are already fully developed so that damage of the leaves or roots caused by collection are meaningless - exept in the species with hibernating roots (P. alpina and perhaps P. variegata).

4. Specific notes and data on cultivation

○ SOIL TYPE AND CLIMATE: Fig. 3) indicates the prefered soil type and - as a simplified summary of fig. 2) - the climate range for each temperate growth type species. The petrophilous species are almost exclusively restricted to wet, mossy and rain-protected niches of vertical or overhanging rocks. Some of the non-petrophilous species may occasionally also be found on rocks.

MIXED TROPICAL AND TEMPERATE PINGUICULA DRAWING BY DAVID KUTT

1. P. grandiflora
2. P. caudata
3. P. ionantha
4. P. primuliflora
5. P. planifolia
6. P. lusitanica
7. P. lutea
8. P. gypsicola

Fig. 4) Ping. vulgaris in autumn, with already developed hibernaculum in the center of the rosette

Fig. 7) Self-constructed cooled growth chamber for Pinguicula on the basis of a household deep-freezer

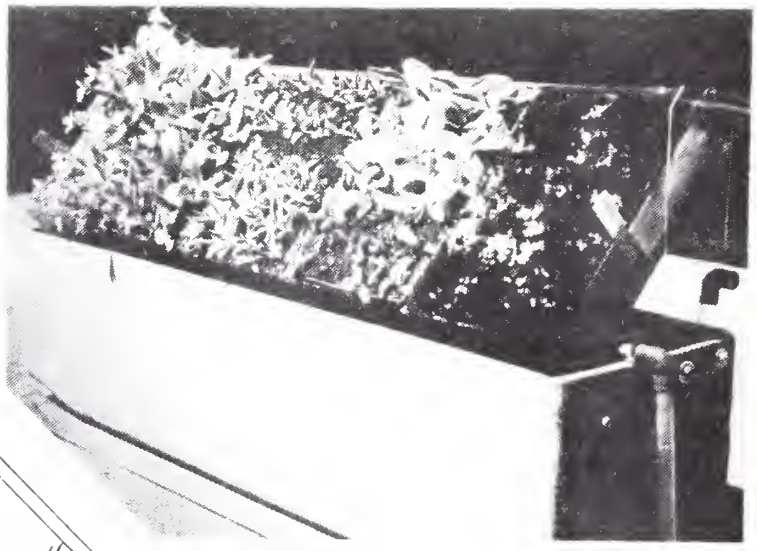
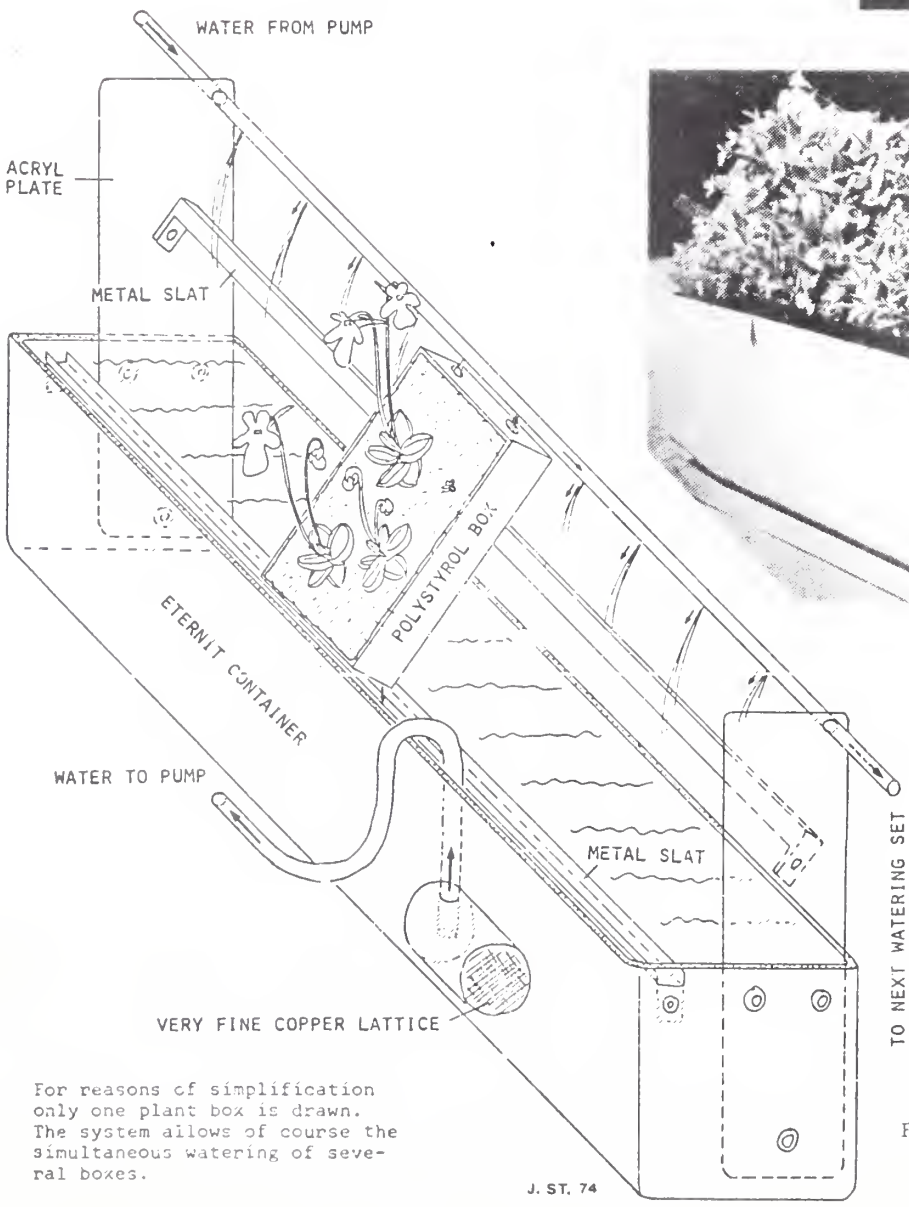


Fig. 5) Watering system for Pinguicula



For reasons of simplification only one plant box is drawn. The system allows of course the simultaneous watering of several boxes.

Fig. 6) Watering system for Pinguicula

GENERAL SOIL TYPE PREFERENCE ▽ / CLIMATE RANGE ▷		TEMPERATE CLIMATE WITH RELATIVELY MILD WINTER (MARITIME OR MEDITERRANEAN INFLUENCE) MID-SUMMER TEMPERATURE 15-30°C 59-86°F	MONTANEOUS AND SUBALPINE OR SUBARCTIC CLIMATE MID-SUMMER TEMPERATURE 10-20°C 50-68°F	(SUB)ALPINE OR (SUB)ARCTIC CLIMATE (TIMBERLINE ZONE OR COLDER) MID-SUMMER TEMPERATURE 5-15°C 41-59°F
PETROPHILOUS SPECIES	calciphobous	P. macroceras ssp. nortensis**	P. ramosa	
	calciphilous	P. vallisneriifolia*	P. longifolia ssp. longifolia*	
		P. longifolia ssp. caussensis* P. longifolia ssp. reichenbachiana*		
NON-PETROPHILOUS SPECIES	calciphobous			P. algida P. nevadensis* P. variegata P. villosa
			P. corsica*	
	calciphilous		P. grandiflora ssp. rosea P. grandiflora f. pallida	
	growing on different soils		P. grandiflora	P. balcanica P. leptoceras
			P. alpina P. vulgaris P. macroceras	

* Species which do not like to be exposed to direct rainfall ** See footnote

Fig.3) Prefered soil type and climate range of temperate growth type Pinguicula species

○ LIST OF PERTINENT DATA ON HABITATS AND ON CULTIVATION: The following list gives some habitat characteristics and some cultivation data concerning temperature, length of vegetation period and recommended soil mixture (see next three pages).
The figures are to be interpreted as follows: The column 'Winter Period' specifies how many months the hibernacula should be kept in a refrigerator at the indicated temperature. '3-5' does not mean 'march-may' but 'three to five months'. The column 'Vegetation Period' shows the analogous values for the summer season, with separate indications for mid-summer temperatures at night and day. The upper and lower values indicate the average temperature peaks which may occur for some few hours each day or night in mid-summer. Plants which are constantly kept at those upper or lower peaks values will not grow well. If daily temperature oscillations in the indicated range cannot be simulated, cultivation will succeed in most cases also by growing the plants at the mean temperatures indicated in brackets. Whenever possible it should be tried to achieve a night-day difference of some centigrades. In the first and last month of the vegetation period the mean temperature should be kept at the lower peak value of the mid-summer temperature. The column 'Soil Substrate' indicates the author's recommendations for the soil mixture, most of them based on personal cultivation experiences. This does not exclude that other substrate compositions will also be adequate. Most suitable for any species is of course the soil substrate from its natural habitat.
If cultivation is done under artificial light it is recommended to simulate the seasonal day length differences, particularly in autumn, as the development of the winter buds is dependent on the combined effect of falling temperature and shortening days. As mentioned above this is at least ascertained for P. grandiflora (7).

** A comparison of living material of P. macroceras from different habitats revealed that the specimen growing in northern California and southern Oregon are rather different from the 'typical' taxon of the (sub)alpine and (sub)arctic habitats in the northern distribution area. The holotypus originated from the Aleutian Islands. Provisionally I name the petrophilous population growing in Del Norte County (Cal.) and Josephine County (Oregon)

Pinguicula macroceras ssp. nortensis ssp.nov.

The chromosome number is 2n=32. A detailed description will be published separately.

CULTIVATION OF TEMPERATE GROWTH TYPE PINGUICULAS - LIST OF PERTINENT DATA

GENERAL REMARKS Distribution and Characteristics of Natural Habitat	VEGETATION PERIOD Months	Mid-Summer Temperatures Night	 Day	WINTER PERIOD Months	 Soil Temp.	SOIL SUBSTRATE
PETROPHILOUS SPECIES (ALPHABETICAL ORDER)						
PING. LONGIFOLIA SSP. CAUSSENSIS Main habitat: Gorges du Tarn (France), 400-1300m. Grows in windy gorges in the moss of shady, wet and overhanging limestone rocks, at locations protected from direct rainfall. Mediterranian climate type with dry summer and wet winter. Winter temperatures only occasionally below the freezing point. Flowering: April-July	7-9	12°-18°C (15°C) 54°-64°F (59°F)	15°-25°C (20°C) 59°-77°F (68°F)	3-5	+1°C 34°F	calcareous ⅓ marly limestone detritus ⅓ sand ⅓ perlite
PING. LONGIFOLIA SSP. LONGIFOLIA Central Pyrenees (France and Spain), 800-2200m. Grows on shady and wet vertical or overhanging limestone rocks in niches protected from direct rainfall. In higher regions frequent fogs (also in summer). Occasionally associated with P. alpina and P. grandiflora. Flowering: June-August	4-6	6°-14°C (10°C) 43°-57°F (50°F)	10°-20°C (15°C) 50°-68°F (59°F)	6-8	+1°C 34°F	calcareous ⅓ marly limestone detritus ⅓ sand ⅓ perlite
PING. LONGIFOLIA SSP. REICHENBACHIANA Roya Valley (France), 600m. Apuanian Alps and Abruzzian Alps (Italy), up to 1400m. Same habitat type as P. longifolia ssp. caussensis (see above). Flowering: April-July	7-9	12°-18°C (15°C) 54°-64°F (59°F)	15°-25°C (20°C) 59°-77°F (68°F)	3-5	+1°C 34°F	calcareous ⅓ marly limestone detritus ⅓ sand ⅓ perlite
PING. MACROCERAS SSP. NORTENSIS (see footnote) Northernmost California and southernmost Oregon (USA), 150-500m. Grows on shady rocks and on rocky bluffs of creeks and rivulets, in wet dripping crevices (Serpentine, mesozoic ultrabasic intrusives). Dry summer and wet winter. Flowering: April-June	7-9	12°-20°C (16°C) 54°-68°F (61°F)	17°-29°C (23°C) 63°-84°F (73°F)	3-5	+1°C 34°F	non-calcareous ½ granite or serpentine detritus ¼ black peat ¼ perlite
PING. RAMOSA Mt. Koshin and neighbouring mountains of the Nikko National Park (Japan), 1500-1900m. Grows in the needle tree girdle on mossy, shady, wet and vertical volcanic rock-cliffs, at places not exposed to direct rainfall. Frequent summer fogs. Flowering: June-July	4-6	6°-14°C (10°C) 43°-57°F (50°F)	10°-20°C (15°C) 50°-68°F (59°F)	6-8	+1°C 34°F	non-calcareous ½ volcanic detritus ¼ black peat ¼ perlite
PING. VALLISNERIIFOLIA Main habitat: Sierra de Cazorla (Spain), 1000-1700m Grows in the marly crevices of shady and soggy vertical or overhanging limestone rocks. No rain in summer, wet and mild winter (temperatures usually above the freezing point). Leaves very long (up to 30cm). Develops off-shoots (runners). Flowering: May-July	8-9	15°-20°C (18°C) 59°-68°F (64°F)	20°-30°C (25°C) 68°-86°F (77°F)	3-4	+3°C 38°F	calcareous ⅓ marly limestone detritus ⅓ sand ⅓ perlite
NON-PETROPHILOUS SPECIES (ALPHABETICAL ORDER)						
PING. ALGIDA Northern Siberia and northeastern Baikal area (USSR), sea level (arctic regions), 1500-2000m (Stanovoy Mountains). Grows in tundras and peat bogs, on bluffs of rivulets and on wet rocks. Cold winter. Flowering: July-August.	3-4	4°-8°C (6°C) 39°-46°F (43°F)	10°-16°C (13°C) 50°-61°F (55°F)	8-9	-3°C (?) 27°F (?)	non-calcareous ⅓ black peat ⅓ granite sand ⅓ perlite

GENERAL REMARKS Distribution and Characteristics of Natural Habitat	VEGETATION PERIOD Months	Mid-Summer Temperatures Night	 Day	WINTER PERIOD Months	 Soil Temp.	SOIL SUBSTRATE
PING. ALPINA Scandinavia and different higher moutain chains of Eurasia (Pyrenees, Alps, Karpates etc., Ural, Baikal region, Himalaya and Chinese mountains), 0-4100m. Grows in different kinds of bogs, on springy slopes and other moist places including wet bluffs and rocks. Habitats may vary from shady to full-sunny. Occasionally associated with P. grandiflora, P. longifolia ssp. longifolia, P. leptoceras and P. vulgaris, but advancing into dryer places than those. Perennial roots. Flowering: May-August	3-5	4°-12°C (8°C) 39°-54°F (46°F)	8°-20°C (14°C) 46°-68°F (57°F)	7-9	+1°C 34°F	different soils ⅓ black peat ⅓ sand ⅓ perlite
PING. BALCANICA Higher mountain chains of southeastern Europe: Dinaric Alps and Pindus Mountains (Yugoslavia, Albania, Bulgaria, Greece), 1900-2400m. Grows on springy slopes, in bogs, on peaty borders of creeks, in gorges and on wet rocks. Timber-line zone and above it. In calcareous as well as in acid soils. Relatively dry summer and wet winter. Flowering: June-August - VAR. TENUILACINIATA (Yugoslavia), preferably on wet rocks. More petrophilous than the typical form - SSP. PONTICA Pontic and Taurus mountains (Turkey), Caucasus (USSR), 1600-3000m. Same habitats as typical form but also below the timber-line	3-4	4°-10°C (7°C) 39°-50°F (45°F)	8°-16°C (12°C) 46°-61°F (54°F)	8-9	+1°C 34°F	different soils ⅓ black peat ⅓ sand ⅓ perlite
PING. CORSICA Corsica Island (France), 900-2400m. In the lower regions in half-shady springy places, in higher altitude also in full-sunny wet slopes. Ground: granite. Considerable variations of habitus according to altitude. Much snow or rain in winter but relatively dry summer. Flowering: May-August	4-6	6°-12°C (9°C) 43°-54°F (48°F)	8°-20°C (14°C) 46°-68°F (57°F)	6-8	+1°C 34°F	non-calcareous ⅓ black peat ⅓ granite sand ⅓ perlite
PING. GRANDIFLORA Western Jura (France, Switzerland), Pyrenees (Spain, France), Cantabrian mountains (Spain), southwestern Ireland. 600-2400m. Grows on sunny or half-shady places of wet meadows and springy slopes near cool creeks (continental habitats) and on peat bogs and 'raised moss' associations (Ireland), both on calcareous and granite ground. Occasionally associated with its f. pallida and with P. alpina, P. longifolia ssp. longifolia and P. vulgaris. Flowering: April-August	4-6	8°-14°C (11°C) 46°-57°F (52°F)	12°-20°C (16°C) 54°-68°F (61°F)	6-8	+1°C 34°F	different soils ⅓ black peat ⅓ limestone or granite detritus ⅓ perlite
PING. GRANDIFLORA F. PALLIDA Western Jura (France, Switzerland), associated with the typical form. On half-shady calcareous and very loamy slopes. Flowering: June-August A similar, almost white flowered form occurs in Ireland (Clare Co.), growing together with the typical species near calcareous springs which trickle slabs of bare limestone.	4-6	8°-14°C (11°C) 46°-57°F (52°F)	12°-20°C (16°C) 54°-68°F (61°F)	6-8	+1°C 34°F	calcareous ⅓ limestone detritus ⅓ loam ⅓ perlite
PING. GRANDIFLORA SSP. ROSEA Mountains near Grenoble (France). Shady or half-shady mossy places on slate or limestone. In this area the typical species does not occur (?). Flowering: June-July	5-6	8°-16°C (12°C) 46°-61°F (54°F)	14°-22°C (18°C) 57°-72°F (64°F)	6-7	+1°C 34°F	calcareous ⅓ limestone or slate detritus ⅓ loam ⅓ perlite

GENERAL REMARKS Distribution and Characteristics of Natural Habitat	VEGETATION PERIOD Months	Mid-Summer Temperatures Night	Day	WINTER PERIOD Months	Soil Temp.	SOIL SUBSTRATE
PING. LEPTOCERAS Alps (Austria, Switzerland, Italy, France), 1200-3000m. Sunny springy slopes, (sub)alpine bogs, glacier moraines and other moist places. Timber-line and above it. Habitats often exposed to wind. In the northern Alps preferably on granite ground, in the Maritime Alps also on calcareous soil. Occasionally associated with P. alpina or P. vulgaris. Flowering: June-August	3-4	4°-10°C (7°C) 39°-50°F (45°F)	8°-16°C (12°C) 46°-61°F (54°F)	8-9	+1°C 34°F	different soils ⅓ black peat ⅓ sand ⅓ perlite
PING. MACROCERAS Northern Pacific coastal area (Japan, Kamchatka Peninsula, Aleutian Islands, Alaska, Yukon, British Columbia, Washington, Montana, NE Oregon), 50-2300m. Grows in very different habitats: sunny springy slopes, wet meadows, glacier moraines and dripping rocks etc. On silicate as well as calcareous soils. Needle tree zone, timber-line and above it. Flowering: June-September	3-5	5°-13°C (9°C) 41°-55°F (48°F)	8°-18°C (13°C) 46°-64°F (55°F)	7-9	+1°C 34°F	different soils ⅓ black peat ⅓ sand ⅓ perlite
PING. NEVADENSIS Sierra Nevada (Spain), 2600-3200m. Grows in the alpine and nival zone in full-sunny springy slopes and other wet places, on silicate ground. Much snow in winter but only few summer-rain. Frequent mountain fogs. Flowering: July-August	3-4	4°-10°C (7°C) 39°-50°F (45°F)	8°-14°C (11°C) 46°-57°F (52°F)	8-9	+1°C 34°F	non-calcareous ⅓ black peat ⅓ granite sand ⅓ perlite
PING. VARIEGATA * Southern and eastern Siberia (USSR), from lowland (eastern regions) up to 1450-2200m (Baikal area). Grows in alpine sphagnum bogs, tundras and on mossy slopes and wet rocks. Timber-line and above it. Cold winter. Flowering: June-July	3-4	4°-8°C (6°C) 39°-46°F (43°F)	8°-16°C (12°C) 46°-61°F (54°F)	8-9	-3°C (?) 27°F (?)	non-calcareous ⅓ black peat ⅓ granite sand ⅓ perlite
PING. VILLOSA (Sub)arctic area of North America and Eurasia (but not occuring in Greenland, Iceland and Spitzbergen), 0-750m. Grows in Sphagnum bogs, hummocks and muskegs around pools and creeks, mainly in the timberline zone. Successful growth presumably only possible in long-day conditions (?). Flowering: June-August	3-4	6°-10°C (8°C) 43°-50°F (46°F)	8°-12°C (10°C) 46°-54°F (50°F)	8-9	-3°C (?) 27°F (?)	non-calcareous small and compact-tufted species of living sphagnum
PING. VULGARIS Eurasia, northernmost mountains of Africa, Iceland, Greenland, North America, 0-2300m. Grows almost in every biotop and in all sorts of soil minerals provided that moisture is sufficient and that the habitat is not too shady. Occasionally associated with P. alpina, P. grandiflora, P. leptoceras, P. lusitanica or P. villosa. Flowering: May-August - **F. ALBIDA and F. BICOLOR** May be found at different locations in central, northern and eastern Europe. Same habitats as the typical species.	4-6	7°-15°C (11°C) 45°-59°F (52°F)	10°-22°C (16°C) 50°-72°F (61°F)	6-8	+1°C 34°F	different soils ⅓ black peat ⅓ sand ⅓ perlite

* According to literature P. variegata has perennial roots (3). On the basis of hibernacula I received from Siberia I would assume that the roots decay in winter. However I am not shure whether the received material was really P. variegata - unfortunately it perished before identification was possible.

○ PLANT CONTAINERS: After several years of cultivation experiments - many were failures - I have found the following kind of containers most suitable: I utilize rectangular transparent polystyrol boxes of 17.5cm (L) x 12.5cm (B) x 4cm (H) as they are used by Ciba-Geigy Inc. for mailing pharmaceutical specimen. Then I rig up somewhat smaller 'boxes' by anticorrosive metal lattice (17cm x 11.5cm x 4cm, quadratic meshes with a diameter of about 13mm, wire diameter about 0.8mm), which are put into the polystyrol boxes. The inside of the metal lattice boxes themselves is lined with a nylon net of 1.5mm mesh diameter to prevent loss of smaller substrate particles. Now the soil mixture is filled into the net-coated lattice box up to its upper margin. Watering is done into the small interspace between lattice and polystyrol container - distilled water for the calciphobous species, tap water for the rest. The substrate should be wet but not soggy, the lattice box should generally not stand in water. Addition of water is necessary each 2-7 days, depending on temperature and air humidity. With this method all sides (even the downside) of the substrate 'block' are constantly exposed to air which reliably prevents any mold. For freeland experiments in natural bogs the lattice box with the plants may be lifted out of the polystyrol box and may be dug directly into the swampy soil, from where it is removable again at any time. The best results in home experiments were obtained by lifting the boxes into an inclination angle of about 45°. Watering is then done by a hose system connected with an aquarium filter pump (Eheim filter): Water can enter and leave the substrate by two wholes each on the upper and lower sidewall of the polystyrol box. The boxes themselves are installed above a rectangular water container (material: eternit or styropor). A timer ('Electro-Boy') is connected with the filter pump, allowing each full hour a watering period of 15 minutes. The filter material is charcoal and synthetic wadding. If fresh tap water is available this may be even better than the recirculating filter water system. However in some regions tap water may be too much chlorinated or too calcareous for some species.

○ SOIL SUBSTRATE: Whenever possible soil substrates from natural Pinguicula habitats should be used. If artificial mixture is necessary it is most suitable for the majority of species to mix fine black peat with sand of the preferred mineralic composition (lime, granite, serpentine, lava etc.) and ¼ to ⅓ volume parts of perlite. P. villosa grows almost exclusively on sphagnum. The petrophilous species require a more sandy soil with no or less peat. Thanks to the lattice box system described above I never had any problems of substrate rottennes in any soil mixture. To kill worms and other vermins I freeze and thaw the soil 2 or 3 times each for some days before using it (at -20°C/-4°F).

○ TEMPERATURE: For hibernation the winter buds and gemmae are stored in a household refrigerator just very little above the freezing point (+1°C/34°F). They are kept either in their lattice boxes or they are put into polystyrol jars of 5cm length and 4cm diameter stuffed with wet perlite and some milligrams of a fungicide/insecticide powder (e.g. Gesal, containing 5% malathion, 25% sulfur, 5% folpet, Ciba-Geigy Inc.). The seeds are kept dry and are stored between 1° and 10°C in small poystyrol boxes (40x40x15mm) after beeing powdered with a very small amount of the above named fungicide. In summer I keep the plants in a self-constructed cooled growth chamber: A usual household deep freezer (from which the cover must be removed) serves as 'chassis' for a wooden chamber of the same length and breadth and 90cm height. The chamber may be opened by two acryl glass front doors. The cover side of the chamber also consists of acryl glass. Above it two light sources are installed (see below). A propeller, connected with a timer, is fastened in the chamber to produce some air circulation from time to time. The northern plants are kept on shelves in the cool zone just some centimeters above the upper margin of the deep freezer. The adequate temperatures are found by lifting or lowering the shelves. The upper, warmer zones of the chamber serve for (sub)tropical species. Another possibility is to use an air conditioner, provided that it cools enough and that it doesn't dry up the air to much. Such equipment is more recommended for larger cultivation settings (e.g whole greenhouse compartments). Further suitable devices are cooled vitrines as they are used for food display in baker's and butcher's shops (such vitrines are available e.g. by Admiral Internat. Corp., Chicago).

○ LIGHT: Plants are grown either in daylight (bright but shady place at north facing window) or under Philips mercury lamp sources of the type HPLR-N (125 Watt). This light has a slight ultraviolet spectrum portion and almost no infrared so that the enlightened environment is hardly warmed up. The distance between light bulb and plants is 50-90cm. The distance between the lower bulb end and the acryl cover of the growth chamber is 6cm - a smaller interspace would cause the acryl to grow hot and to split.

○ PROPAGATION: Pollination is carried out with insect pins nr. 0 or 00 (brass or nylon heads). Pins contaminated by Ustilago-infected pollen are thrown away as well as the infected plants themselves. Seeds are sowed into the same substrate as used for the adult plants and into lattice boxes likewise. For regular sowing seeds may be mixed with very fine sand or peat dust. Gemmae are removed from the hibernacula in autumn or spring and cultivated mostly together with the seedlings. Some (sub)tropical species as P. gypsicola and P. moranensis may be propagated by means of leaf-cuttings. However this procedure is not applicable in any of the temperate growth type species. Another subtropical species, P. primuliflora, forms new plantlets at the tips of the adult leaves. Also this mechanism of vegetative propagation was not observed in the hibernaculum-forming species. A peculiarity amongst the temperate growth type species are the runners formed by P. vallisneriifolia. Their connexions with the mother plants generally decay in winter.

5. Acknowledgements

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Once again, we are providing CPN members with the opportunity to order CP books published in Japan. They are written in Japanese, but many of them are generously interspersed with excellent pictures both in color and black and white of many CP species, some titled in their Latin names. Several of these books that we offered in the past are now sold out and are out of print. So, while the limited supply lasts, we offer the following books at prices that include all postage (overseas and domestic). Please send your check or money order to J. Mazrimas before May 1, 1975. Expect a delay of one or two months before you receive the book you ordered.

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RECENT LITERATURE

Angerilli, N. and Beirne, B.: Influences of some freshwater plants on the development and survival of mosquito larvae in British Columbia. Can J. Zool. 52(7): 813-815, 1974
Plants like Lemna minor and the algae Chara globularis apparently produce juvenile hormone-like compounds and affect development of larvae of Aedes aegypti. U. minor ingests the mosquito larvae while other species facilitate the activity of predators of the larvae.

Barber, Ann: The hungry pitcher. Outdoors in Georgia, 3:23-26, 1974.
A popular article discussing the properties and conservation of south Georgia Sarracenias; four fine color photos.

Clark, Phil: Step into my parlor. Plants Alive, 3:32, 1975.
A one-page article, one photo, on Mexican Pinguiculas, including growing technique briefly described.

Ferreira, D.P. and Small, J.G.C.: Preliminary studies on seed germination of Drosera aliciae, Hamet. Journ. S. Afr. Bot. 40(1) 65-73, 1974.
After sterilizing the seed with alcohol and mercuric chloride solutions, the authors sowed the seed on filter paper which was set into sterile petri dishes. They determined after many experiments the following optimum conditions for germination: A pH of 5.5, a temperature of 10° C. in continuous light or 15° C. in continuous dark. No matter what treatment was applied, the seeds germinated only after twenty-four days in the imbibed state. Seed was stimulated to germinate by applications of potassium nitrate, boric acid, gibberellic acid, indole-3-acetic, and kinetin. Boric acid at the level of 0.05 ppm stimulated old seed more than any other chemical treatment.

Fineran, B.A. and Lee, May S.L.: Transfer cells in traps of the carnivorous plant Utricularia monanthos. J. Ultrastruct. Res. 48(1): 162-166, 1974.
Transfer cells are reported in the glandular epidermal hairs which line the walls of the trap of U. monanthos. The most highly differentiated transfer cells are those of the quadrifid and bifid hairs.

Hellquist, C.B.: A white-flowered form of Utricularia purpurea from New Hampshire. Rhodora 76:19, 1974.
Found as exclusive form in a pond in Carroll County; formally described as f.n. forma alba.

Hooft, J.: Vegetative reproduction in flytraps. Carolina Tips (Carolina Biological Supply Company, Burlington, NC 27215) 37:57-58, 1974.
The author discusses vegetative apomixis in Dionaea as he has observed it in nature and in culture. Also, a technique of vegetative leaf budding is described, and the occurrence of this in nature is also discussed.

Jacobson, Stuart L.: Effect of ionic environment on the response of the sensory hair of Venus' flytrap. Can. J. Bot. 52(6), 1293-1302, 1974.
Single cells of the sensory hairs were excised from the leaf of this species and were impaled with KCl-filled micropipettes. The resting potential was affected most by potassium ions while the amplitude of the response potential increased linearly as the log of magnesium and calcium ion concentrations.

Miles, D., Howard, Mody, Naresh, V.: A draught from the poison pitcher. Science News 106, 286, 1974.
These chemists isolated two amines responsible for paralyzing flies in pitcher plants. One is called coniine and is one of the major volatile alkaloids found also in the hemlock plant. The other was not fully characterized.

Pickard, B. G.: Action potentials in higher plants. The Botanical Review. 39, 172-201, 1973.
A good review of action potentials in many species of plants including Drosera and Dionaea.

Trappe, J.M. and Gerdemann, J.W.: A northern extension of the range of Darlingtonia. Madrono 22, 279, 1974.
The range of Darlingtonia is extended about 100 kilometers north of earlier recorded sites into Tillamook Co., Oregon. Plants were growing on hummocky, slightly sloping bottomland with numerous rivulets and small streams. Trees in the area were Thuja and Pinus. Myrica californica is a typical associate of Darlingtonia. Drosera rotundifolia also was found here.

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CO-EDITORS: D.E. SCHNELL, RT. 4, BOX 275B, STATESVILLE, NC 28677, USA
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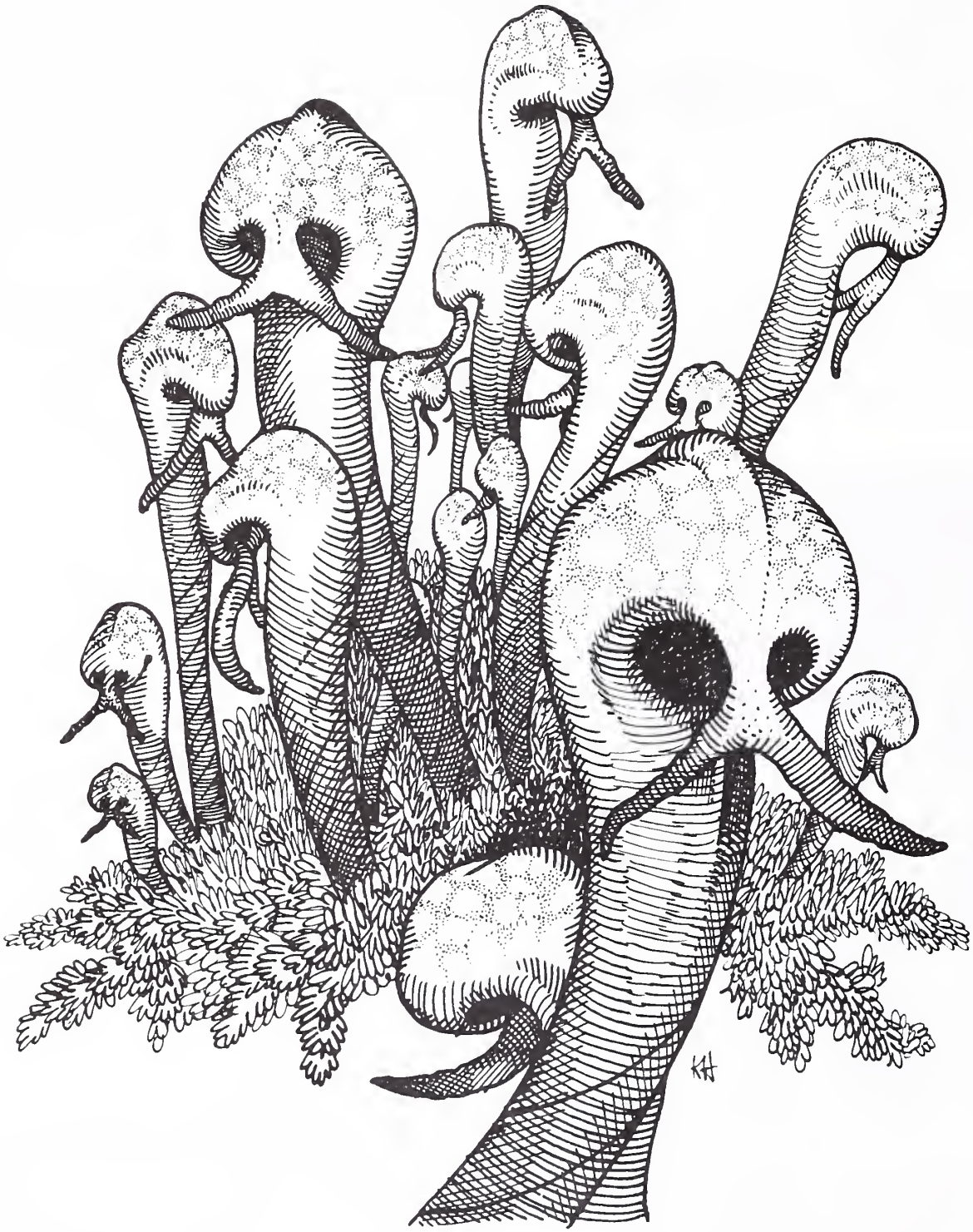
MULTIFIDA

Photo by A. ROGER KIRBY



DARLINGTONIA CALIFORNICA

drawing by KIRK HENDERSON

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NEWS AND VIEWS

STEVE DENNIS has written several items of news, one that there is supposedly a station for Sarracenia leucophylla near Walterboro, South Carolina, which he has to verify. He also has a Dionaea with six trigger hairs on each leaf lobe (twelve per trap) that appears consistently leaf after leaf. He would finally like to caution excessive use of Benomyl on seedlings of Byblis and Drosophyllum where it appears to him to be somewhat toxic.

ZELIMIR SAHIN sent us a garden magazine from the Netherlands called "Der Garten als Jungborn" January, 1975. On pages 18 and 19 there is an article written on Nepenthes species by Karlheinz Jacobi. The article describes the origin and cultivation of the genus, and two pictures accompany the written piece: N. bicalcarata and N. mixta.

BILL HANNA sends us a note: "I have come across a stamp which features a Nepenthes from the Seychelles Islands, Nepenthes pervillei. It was issued on the 29th of December, 1970. It has the Stanley Gibbons British Commonwealth Stamp Catalogue number of 285."

JOE MAZRIMAS notes: "In the spring of 1973, I was fortunate to finally have both Drosera filiformis typica and Drosera filiformis var. tracyi in bloom at the same time. I decided to cross these two plants to find out if the resulting seed was fertile and to find out what type of characters will dominate in the hybrid. Using typica as the seed parent, I pollinated the stigmas with pollen from the tracyi plant. I pollinated about fifty flowers over a period of three weeks. Seed developed in the ovaries and after harvesting them, I sowed some on the surface of wet peat moss and sent the rest out to various individuals to grow. STEVE CLEMESHA of Australia was one of these individuals who managed not only to germinate the seed but in a recent letter was the first one to report that the hybrid bloomed. He reports: 'Vegetatively, the hybrid has pink-colored tentacles borne on tall filiform leaves which means it has the typica tentacles and the tracyi size. From the flower viewpoint, the hybrid has large flowers in which the stamens are longer than the styles which is nearer to the tracyi type than to the typica type whose styles and stamens are nearly equal in size.' Steve self-pollinated the hybrid and is now waiting for the swollen capsules to yield its mature seed. We are eagerly waiting for germination of the seed."

Steve also reports on an experiment to test the fact if the five stigmas on the Sarracenia flower are separate, i.e., leads to separate ovarian compartments or if they are mixed. He pollinated only one stigma and cut off the rest. Seed was found in all five compartments and they were as full as his control with five stigmas pollinated. It seems that five stigmas just increase chances of pollination, and if only one was pollinated, then a full seed set would still be obtained. (Coincidentally, DON SCHNELL made histologic cross sections of the narrow style component, style-ovary junction and the ovary. There is a hollow canal, somewhat stellate in shape, leading down the center of the narrow portion of the style, and this ends in a large penta-stellate compartment in the ovary. The points (on cross section, ridges on longitudinal section) end on the placental partitions containing the ovules. Pollen tubes coming from any one or more stigma lobes will have free access to all the ovules, thus anatomically confirming Steve's experiments.)

LARRY DeBUHR has returned from three months in W. Australia where he studied Drosera. He has photos of most of the species of the southwest region as well as many Utricularia, Polypompholyx and Cephalotus. He has also found two new species of Drosera which will be reported in ALISO in the spring, 1975.

BOB HANRAHAN is a ham radio operator (WB6GWY, Santa Ana, Ca.) and he says he has capabilities for worldwide transmission. He wants to encourage other hams to give him a call. Further, the co-editors invite all you ham operators to send us your call letters for publication so you can readily contact each other. Perhaps we will start a CPN radio network!

DAVID J. THOMAS and ARMAND LIONE sent in the following report: "We have recently heard of an abstract in the CPN reporting the absence of protein secretion in Sarracenia purpurea. We would like to communicate our preliminary results in this area.

"S. purpurea Linn. individuals were collected from a large bog in Mendon Pond Park near Rochester, New York, and transplanted to a local greenhouse. The following experiment was designed to evaluate the pattern and magnitude of protein secretion by the plants. Sarcophagi were first flushed repeatedly with distilled, deionized water. This continued until the sarcophagus appeared free of organic material and the flushing water was clear. Each sarcophagus was then filled with 8 ml. of distilled, deionized water and closed with absorbent cotton to prevent contamination. At intervals, up to 120 hours after the beginning of the experiment, contents of the sarcophagi were sampled. These samples were concentrated and aliquots analyzed by the method of Lowry et al. (Lowry, O.H., et al., Journal of Biological Chemistry, 193, 265-275, 1951) to determine the total protein content of the sarcophagal fluid. Data on the protein content of this fluid revealed no clear pattern of protein accumulation over the entire experimental period. This finding suggests that either protein is not released into the sarcophagus or that the necessary stimulus for release did not occur."

STEVE KAPA has some information on Drosera leaf cutting propagation: "Los Angeles growers are experimenting with a very easy method of propagating Drosera leaf cuttings. Simply float the leaves on a thin layer of pure water in any transparent container and cover to prevent evaporation. At room temperature under lights new growth initiates within two to eight weeks, depending on species. Often many plants can be started from a single leaf. Sam Potter reports one notable exception: D. schizandra leaves rot easily when wet, so this species does better on damp sphagnum. So far, no one has been able to vegetatively propagate D. burmanni or D. villosa by any means. The water method works with Pinguiculas although some species may be susceptible to rot. Australian pygmy Droseras present another special case. Most of them are native to southwest Australia with a wet winter, dry summer Mediterranean climate. They survive the dry season by forming tight dormant buds and producing gemmae, small flat plates at the tips of the leaves. These gemmae form new plants when the autumn rains splash them far and wide. Recently I was able to induce gemmae formation in D. dichrosepala by growing it outdoors (in a tank) during autumn and keeping the pot somewhat dryer. Within a couple of months the loose gemmae could be plucked from the center bud and growth resumed when more water was added. Another method for pygmy Drosera is to peel the whole leaf carefully away from the plant and set on a damp surface. A new plant will emerge from the leaf base in four weeks."

JACQUES HALDI grows Utricularia and will experiment with Aldrovanda in water that had percolated through peat moss. A container of peat moss is set under a dripping faucet and the water runs through and out a hole in the bottom to which is fixed a regulatory stopcock. This water is then in turn dripped (cascade effect) into a tank in which the plants are growing. There is an overflow water leveling hole in the latter tank to maintain level and also result in a constant flowthrough of freshly peat percolated water.

DR. EDGAR WHERRY went to a fern meeting at Longwood Gardens where he noted the fine CP collection there, particularly the Nepenthes. There were no southeastern U.S. species of Pinguicula, although most other genera were represented, but there was a large Mexican Pinguicula in full flower. Dr. Wherry points out that the water at Longwood is neutral, while in Philadelphia it is too basic and charged with toxic industrial wastes from upstream.

PAUL DEBBERT reports on his methods for growing Drosera from South Africa and the tuberous ones from Australia. It is a question of light, temperature and water. The growing season in Germany begins about August lst, during this time the plants need much sun and water. The day temperature is about 20°-25° C. (68°-78° F.) and night temperature is about 5°-10° C. (40°-50° F.). Dormant period starts with yellowing of foliage from the end of April to about the 20th of May. Then bulbs and tubers remain dormant until the end of July. During this time give very slight watering but do not permit drying.

In CPN III, 45, 1974, BILL HANNA described a Nepenthes species that is planted outside his brother's house, probably on the south side of a veranda near Lake Macquarie, Newcastle, Australia. He lives on the coast at 33° south latitude which is more than 10° lower latitude than any natural occurring Nepenthes is found. The humidity in this region averages 70-74% and summer temperatures of 80° F. (25° C.) while the winter temperatures drop down to 48° F. (8.7° C.) at night. From pictures and a cutting of the plant itself, we tentatively concluded that the species is N. maxima or a close hybrid to this species. It is strange to find that this species has adapted itself to low temperatures and grows vigorously with large pitchers at the most extreme latitude that we know.

STEVE CLEMESHA sends us a few noteworthy experiments he carried out with Sarracenia seed. "In the seed of S. purpurea forma heterophylla, I pre-chilled half of them for six weeks on damp sphagnum moss and planted the rest straightaway. The ones I did not pre-chill commenced germination first but less of the seed germinated and additional ones are still coming. The pre-chilled ones germinated altogether and very few failed."

JOHN TURNBULL wrote in suggesting that we also include in our literature review section various articles not directly pertaining to CP but which might be peripherally related, such as the one in this issue on embedding plant parts in plastic (Chequer) and one several years ago on the chemical properties of various soil additives such as perlite and vermiculite frequently used by CP growers. We will be happy to include such material as long as some sort of CP relationship can be demonstrated.

EDWARD N. BALKO has discovered an out of print book copying service: "University Microfilms in Ann Arbor, Michigan, operates a service which supples out of print books. A microfilm copy is made of the book and stored at Ann Arbor. For about $10 University Microfilms makes a Xerox-type copy of the book and binds it (clothbound is optional) for the requestor. There is a $25 fee for locating and microfilming the desired book--this is only charged to the first person ordering--subsequent orders cost $10."

The most urgent application of this process would be to make available copies of the long

out of print CARNIVOROUS PLANTS by Lloyd. Since the initial $25 charge includes negatives and one copy, and any ensuing copies in the same order are only $10, a group of readers may wish to get together on this and place one order for a larger number of copies and spread out the initial extra $15 charge. However, one of your co-editors has received unconfirmed rumors that Lloyd is set for reprint or that a number of copies have been found in a warehouse and are being offered for sale. We will keep you informed as this develops.

ROBERT BALLENTINE sent these comments: "When I subscribed last month to the CPN on the strength of R. Schwartz's book, I would not have been at all surprised to receive one of those cutesy ramblings, the favorite of African violet growers. Therefore, you can imagine my pleasure in the first issue I just received to find a fine serious publication. The contribution by Jurg Steiger is an excellent one both to the botanical ecology and horticulture of the Pinguicula. Naturally, I did not have the chance to fill out one of your questionnaires, but perhaps you might pardon my making a comment. Please do not completely bow to those who do not wish technical articles. Let them reach once in a while, but also have some material at all levels. Only in that way, I think, your more serious and trained readers will have the serious technical articles that will interest us. Neither group, in other words, should be ignored. After all, there is Horticulture and Plants Alive available.

"When I subscribed, I sent in my name as just an interested party. You might like to record the fact that I am Associate Professor of Biology at the JHU, my field being environment biochemistry and microbiology as well as present work on the use of DNA in the phylogeny of the algae. However, my interest in CP dates back many years to reading Darwin's book in my youth and observing Drosera in the sphagnum 'bogs' in Maine."

ROGER KIRBY has had the fastest germination time for Drosophyllum seeds that we have heard of yet. He sent in his technique: "After receiving Drosophyllum seeds from the CPN seed and plant exchange and not knowing for sure the best method to use for germination, I did the following. On March 3, 1975, I took three seeds, scratched them well on fine sandpaper and placed them immediately on finely chopped, wet live sphagnum in a drained plastic pot. There was no other pretreatment. I placed the pot in a ten gallon aquarium tank that had one-half inch of water in it and covered it with glass. All this was placed under two four-foot 40 watt Agro-Lites that were eight inches above the top of the aquarium, 16 hour photoperiod. On the thirteenth (10 days later), I checked my setup and found that all three of the seeds had germinated. On the nineteenth I very carefully placed the sprouted seedlings in a mixture of 50-50 perlite and peat and removed them from the tank. A once weekly mist spraying sufficed for watering. The plants are still under the lights and at this time are all doing well."

FRED CASE has formally described what he feels is a new and distinct species, Sarracenia alabamensis. These plants occur in disjunct locations in central Alabama and are quite rare, tending to decrease almost yearly in their natural habitat due to the sort of land misuse we who do field work are all too well aware of. He anticipates an onslaught of requests for information on these populations and is correctly refusing to divulge exact field locations in the interest of conservation for which Fred has an excellent track record. But to help meet the needs for further study, he is offering to distribute a few seedlings of his own plants, and some seeds to the seed and plant exchange this fall. Serious students may make further inquiries directly to Fred Case, and, of course, Bob Ziemer will be in touch with him regarding seeds for the exchange.

SAM POTTER suggests another book for defining botanical morphology terms, available in paperback for only $2.75: Harrington and Durrell, HOW TO IDENTIFY PLANTS. Sam did not mention the publisher, but it can probably be found in the master index that most bookshops have and through whom you may order the book. Also, he mentions that The Plant Shop, 11366 Ventura Boulevard, N. Hollywood, CA 91604, deals in exotic and some CP. They do not have a catalogue yet but will accept inquiries.

PETER PRAGER writes in to say: "Recently my CP, which I grow in terrariums with lights, were infested with mealy bugs. I did not want to use commercial insecticides because I heard that they could be very damaging. So I removed the plants (Drosera, Pinguicula, Nepenthes, Dionaea, and Sarracenia) from the tanks, rinsed them well and then submerged them in distilled water for five days to hopefully drown any remaining insects and eggs. Though probably impractical for those with large collections, it proved very successful for me. There have been no bugs in the three months since I submerged the plants. The plants did not seem to suffer from the submergence (except D. pulchella, which rotted) and in fact, I have been treated to an added bonus. Very shortly after transplantation, many of the Droseras, including D. adelae and D. hamiltonii began producing tiny plantlets all over their leaves and now my collection of Drosera has virtually doubled in number!!! On just one leaf of my D. adelae there are eight plantlets!"

RESULTS OF FIRST CPN POLL (SEPTEMBER, 1974)

(Continued from last issue)

COMMENTS ON QUESTIONS 7 & 8

1. Any legal problems?
2. Yes, if it seems many people find variations in quality from one to another.
3. Also, evaluate the methods that commercial establishments use to gather and sell CP; i.e., are they collected in the wild or are they propagated?

COMMENTS ON QUESTIONS 9 & 10

1. Personal communication would be best.
2. Only by correspondence.
3. If it becomes too easy to get to places, they are too easy to destroy.

COMMENTS ON QUESTION 14

1. Some people may be growing CP for a hobby and may not have time or knowledge to write a printable communication to CPN at regular intervals.
2. This would create many problems--editorial as well as financial for CPN.
3. Would be difficult for secondary school teachers like myself and for students getting interested in the field. Also, libraries wouldn't be able to order.

GENERAL COMMENTS

1. How about a wanted to buy, sell or exchange column?
2. The members' communications are very valuable. I have passed on copies (for loan) to interested people. Two are sending in membership.
3. I would appreciate it if contributors would explain some of the, shall we way, "scientific terms" in their articles as some of us dummies are not botanists.
4. I want to see popular articles mentioned too in CPN. (In Literature Review section since beginning.)
5. I would like to see a classified ads section in CPN and perhaps things offered for sale by CPN such as pamphlets, slides, photos, etc. How about a question and answer column? Could there be a Junior's column or am I the only junior member?

LONGER COMMENTS SENT IN WITH THE POLL

Walter Hodge comments on questions 9 and 10:

You would be doing a great disservice to conservation in this country to follow through on this--even if the reaction was overwhelmingly positive. The information would hardly be limited to subscribers but be available to anyone including dealers wanting to earn a "fast buck" at the expense of some of America's most fascinating plants. You would do well to emphasize instantly the gist of the paragraphs (under "Conservation" pp. 21-22) written by Shetler and Montgomery in Information Leaflet No. 447 (1965) by the Smithsonian Institution on Insectivorous Plants. I suggest you reproduce these words annually as a service and warning to all subscribers.

Leo T. Barber comments:

Too few of the plant collectors are willing to collect only a few plants to permit land owners to allow them to collect unsupervised. We have in my family ownership some very extensive bogs that we are happy to allow interested persons to visit, photograph and even collect. I would not want to give blanket permission to anyone to visit this property but would be happy to show these bogs to interested persons who contact me personally. We are very interested in developing some procedure for preserving these and other bogs.

Raymond Jillson comments on question 4:

Regardless of whether we go to a more expensive journal or not, I would hate to see the cheaper newsletter be discontinued since it fits the student budget. I can imagine that even college students would find it hard to maintain more than one subscription to a periodical at today's prices. I think we must recognize that a CP journal would be strictly a luxury rather than a necessity even to a botany student who may have a greater need to subscribe to a general botany journal or Fremontia. I may be wrong, but I would hate to see the dissemination of information limited so that we end with what seems to be a large trend toward popularity of CP but with the majority of people keeping only fly-traps and pitcher plants and keeping them wrong with resultant loss and the whole thing amounting to a fad again. To me, the big aim is to get as many people keeping CP varieties as possible with enough interest that a lot of cultural and behavioral information would result and we all could eventually keep them much more easily.

David Lane comments:

On question 5, could there be a third direction? Not toward either a more formal botanical journal, or a more organized horticultural society bulletin, but rather a direction toward a CPN much like the present edition, except with a copyrighted,

legitimate, and quotable "short notes" section. That is, I like to see a section of short articles (with bibliography and addresses, etc.) which offers the following advantages: low subscription rate; wide audience of varying levels of interest and background; low barriers to communication (N&V and "Commentary" not sacrificed but maybe expanded); limited but professional quality; referenced in other publications; recognition. Could CPN be as unique a publication as CP are unique plants?

Kenneth Yapkowitz comments:

Questions 3 and 4 deal with the creation of a more structured organization and an elaborate bulletin. Part of the excitement of CPN, as it currently stands, is in its informality and intimacy. A non-expert would not feel as free to contribute reports of activities, experiments, or discoveries to a more formal publication, I cannot see how the content of CPN could improve by such a move, except, perhaps, the ability to print better quality photographs (if the suggested slide library is established, this would not even be a consideration). I suspect that the tone of the publication would suffer. If such an organization were formed, I would pay the extra fee, just to keep in touch with the others interested in carnivorous plants. But perhaps as an alternative for those who wish to meet with others in their area, face to face, you could make the subscription list available to interested people at some reasonable cost. This would serve as a directory, and local groups could get together for whatever activities they desire, getting in contact with one another through the use of this directory. This would be more desirable than a highly structured, expensive, international organization. Question 10 asks for the location of carnivorous plant bogs in my area. I do not think that there are any in southern California. I do travel often, and I would like to see the plants growing in the wild, so I would be very interested in the maps you mentioned in question 9. I would not do any collecting at such locations, because I believe that there are too few wild spots now, and I would like to preserve them for future enjoyment. For the same reason, I would like to participate in some slide lending scheme (questions 11 and 12). This would be especially valuable on the international level, allowing us to see some imported plants growing in their natural areas. Thank you for a very enjoyable publication. I hope CPN can grow without losing its feeling of community.

Bob Ziemer comments:

I feel the value of CPN is a place for rapid communication of ideas and hypotheses. I would not favor a change in this policy to more formal publication policy. If someone has published material, then the paper should be published, along with technical and editorial review, in a journal. Leave CPN as a place for bouncing ideas and cultural information. Existing journals are weak in this area where CPN is strong.

R. M. Albrecht comments:

Regarding questions 9 and 10, this sort of information in the wrong hands is dangerous. We don't want to add to the list of endangered (e.g., often "collected out") species. It is difficult enough to enforce regulations regarding our presently "protected" species. General ranges would be fine and specific locations would be acceptable when they were located in nature conservancy, scientific areas, arboretums, etc. where collection of any plant material is prohibited without research or collecting permits issued by persons generally knowledgeable regarding the ecology and reproductive capacity, and general condition of the plant in question.

Robert Haynes comments:

The pictures in the last couple of issues are much better but they still aren't as good as the ones in Vol. I, 3 and 4 and Vol. II, 1 and 2. The earlier ones are of a quality that you would expect in a professional journal, and I would be willing to pay $5.00 per year or more if these could be duplicated. A suggestion that I have is the possibility of using the good process to slowly (over the period of years) include pictures of all the terrestrial and epiphytic species of CP. If twelve species could be pictured in each issue, the job might get done in four to five years. Good pictures are a valuable addition to the sometimes confusing taxonomic descriptions. For the many plants with distinctive leaf and pitcher forms, pictures of the flowers may not be necessary.

Peter Taylor comments:

I would hate to see these plants explored on a commercial scale, like, say, the orchids, and there is no way of stopping the trade stepping in if exact localities are published. Given a demand, I'm sure the trade can propagate CP from stock by conventional or more modern methods without further stripping of wild populations. Of course, it is much easier for them to go out with a truck and trowel.

Adrian Slack comments:

I want to see more botanical drawings and descriptions of the lesser known CP. There is too little available in English on the genus Drosera, and I would like to see short botanical descriptions of as many species as possible as well as subspecies and forms. If possible, all species with line drawings should show distinguishing features. This could be achieved gradually, either a few per issue, or, if both sides of a page were used, these could later be bound into a booklet. It could conclude with a few notes on propagation and culture. Later, I would like to see the same done for Pinguicula and Utricularia. On question 9: such

maps would be useful, but they should exclude bogs with a low population of species, or which includes a species threatened nationally with extinction--too many collectors can be tempted! It has happened too much here. On question 10: only providing there is no threat that the plant may become locally extinct.

H. Ruth Netherton comments:

I am strictly an amateur horticulturist with a smattering of botany and a whole lot of entomology. (That's how I got into carnivorous plants--through the insects.) As far as the balance of contents, I would like to see an article on disease affecting CP and what to do about them. I definitely think CPN should be a quotable literature source. If you look back over the past volumes, I think you'll find that several new species have been described in CPN. For that reason only, it would just about have to evolve into a recognized quotable source. At the same time, four issues a year is good. You can have a better quality newsletter which whets your interest for three months. At the same time, I don't think it should be compulsory to have an article in CPN at regular intervals. By article, I'm including "news and views" as well as "short notes." I am afraid that you would get too many of the "Hi there! My Venus' Flytrap is blooming" type contributions. Those who are interested and have something new will communicate. If you do decide to set up a lending library of papers or slides, I would be happy to volunteer as a librarian, provided there would be a small budget to help with the postage, and so on. And if Oklahoma is not an out-of-the-way place for it to be located. I am convenient to the University of Oklahoma, Oklahoma State University, Oklahoma City University, Central State University, Phillips University, Oklahoma College of Liberal Arts, and Southwestern State College. So I shouldn't have a lack of libraries to go hunting in.

EDITORS' OPINION ON CPN POLL

The editors published this poll on the basis of many questions directed to us through correspondence from subscribers. You have read the results and now we would like to give you our opinions:

1. We are pleased that over 80% of you approve of our CPN content and we will continue high quality output as always.

2.5. We will remain informal and so we find it unnecessary to copyright anything that is written in CPN. It is thoroughly understood that anything found in CPN is freely quotable in the open literature just as long as proper citations are given.

3.4.6. We feel that four issues per year is all that the present editors can handle at present as far as time commitments and the quantity and quality of written material that is arriving. In order to increase the number of issues, some extra help will be needed. We feel that when that time arrives, some type of organization should be set up to handle the numerous duties that this effort entails. At that time, perhaps a more formal approach in the form of a CP society should handle the details of execution, production and publication of a more extensive and elaborate newsletter. The journals of other plant societies have several thousand subscribers which alleviates the problem of expense for a more elaborate format.

7.8. We have decided to drop from publication those commercial CP places which do not follow common business practices and courtesy regarding the mail order of CP. If we receive extensive complaints about a particular CP nursery from our subscribers, we will be justified in dropping the listing of that business from our annual list. Before we initiate a poll, we would like to see how such a policy will operate for at least a year.

9.10. CPN has a policy that is conservatory in both philosophy and practice. We believe and will strongly emphasize in future articles the propagation of CP stock via seed or vegetative means. Over 250 species out of about 500 species are currently grown in cultivation according to the latest Ziemer seed exchange information. We urge that this stock be extensively distributed via seed and vegetative reproduction and that any further harvesting of plants from the field be markedly curtailed. As new species are acquired, we urge the grower to carry out rapid reproduction and distribution to prevent any further depredation from the field. We leave the maps and location details of a particular site up to the author's discretion when he submits a short note to CPN.

11. We will communicate details on the slide lending library in a future issue of CPN. We are continuing our search for a volunteer to run this program.

12. We will continue to publish pictures of CP as in the past using improved techniques. Perhaps many CPN members will satisfy their appetites for good pictures by future support of a slide lending library.

13. A book library is clearly in the majority. We will report on its initiation in a future CPN issue since we have a possible volunteer.

14. Finally, we are satisfied so far with the slight increase in the number of

communications that have reached our office for publication in CPN. We hope that we can rely on a steady flow of short notes and other communications in the future. So if you have something to write, do it now!

SHORT NOTES

THE BYBLIS FAMILY
by J.A. Mazrimas

There is a carnivorous plant which is so thoroughly covered by fine, dense tenticular hairs that not only the leaves and stem but also the flower stalk including the calyx is protected. It belongs to the family name Byblidaceae, and I will be discussing the only two members of this family, namely B. gigantea and B. liniflora.

The genus name, Byblis, is derived from mythology and as Roman legend has it the nymph Byblis, a niece of Sol (the sun), shed so many tears of unrequited love that she turned into a water fountain. It is rather interesting that the species gigantea which is given to the larger plant is frequently referred to as the "rainbow plant" because the glandular hairs that are covered with tiny dewdrops usually are reflected by the sun's rays into a spectrum of colors. The smaller species, liniflora, means flax-flowered referring to the resemblance with the slender, erect annual of the Linum genus which has blue flowers.

Byblis gigantea is a plant that grows in moist sandy loam around Perth, Western Australia. Because the seasons are reversed in the southern hemisphere, this coastal city enjoys winter in July with temperatures fluctuating between 48° and 62° F. During this time, hundreds of these plants can be found growing from fifteen to twenty-four inches in height. When summer begins in October, the rainfall diminishes considerably and most of the plant dies back during the hot, dry season. New shoots will emerge from the old perennial root stock as moisture returns in the new season.

The long, linear leaves are usually pale green or yellow-green. At the attachment to the stem, the leaves are three-sided and eventually will reach a final length of eight to ten inches. New leaves are frequently found with swollen reddish tips as they are growing. As mentioned above, all surfaces of the plant are densely covered with glandular hairs which are very efficient in trapping small flies and mosquitoes. Two types of glands are found: the stalked gland captures the insect with its long hairs and sticky secretion and the sessile gland, which lies close to the surface of the stem and leaves, is responsible for the digestion of prey. Thus the plant supports its rapid development by absorption of minerals and nitrogen from the soft parts of the captured insect. It is by this means that the plant is capable of growing in soil with low nitrogen content free from competition of other plants.

In contrast to B. gigantea, the new leaves of Byblis liniflora uncurl in a circinate fashion away from the center of the plant. These leaves are also three-sided at the base and they are capable of reaching a length of about four inches when fully uncurled. Also, I noticed that the stalked glands seemed to be highly variable in length with some of the longer ones about five to six times the length of the shorter type.

The most unusual flower arises singly on long stalks from nearly every axil of every leaf. The flower structure is based on the number five with its five petals exhibiting an iridescent lilac or magenta color in the case of B. gigantea and a pale blue color for B. liniflora. The brilliant yellow anthers provide striking contrast to the petal colors. During the daylight hours, the flower opens, especially on bright sunny days, but closes up in late afternoon. This cycle is repeated for two to three days until the flower closes permanently after pollination.

As mentioned earlier in CPN I, 38 (1972), Byblis seems to have a method of pollination unlike any other carnivorous plant. The stamens which are unequal in size are bent into a definite curve and directed toward the stigma. When pollen is released from the anthers through apical pores by vibrating them vigorously, a cloud of the yellow pollen dusts the purple stigma very efficiently. The availability of this pollen seems to be dependent on warm temperatures and several hours of sunlight falling on the plant. Perhaps in nature, not only insects but also birds and animals brushing against the flowers can vibrate the flowers sufficiently to elicit this response. This will assure self-pollination which results in viable seed.

After pollination, the seed capsule enlarges rapidly as it is protected from parasitic insects by the glandular calyx during development. In B. liniflora, the seed capsule becomes transparent near maturity and a few days later, it splits open to release the seeds to the ground. In the case of gigantea, the larger species prefers to hold onto the seed inside the capsule until the entire plant dries up. The entire capsule with seed firmly inside falls to the ground. Later, in the hot sun, the capsule splits open releasing numerous small black round seed possessing irregular wart-shaped testa.

Growing B. liniflora from seed is relatively easy since the seed germinates readily when

sown on a peat-sand mixture. It grows rapidly in strong light and warm temperatures around 80° F. The plant prefers good drainage, and I like to fill a third of the pot bottom with perlite and the rest with a mixture of perlite and peat or sphagnum. In cultivation, I can grow this plant as a perennial although in nature, it seems to grow as an annual. After growing it for a year or more, the stem becomes very long and cannot support the weight of the top growing portion any longer. One can cut the stem and repot the top portion which roots very easily while the bottom half will send out new shoots. Leaf cuttings will also yield new plants if placed on the surface of peat moss.

Growing B. gigantea from seed used to be very difficult until recently. It was reported in CPN III,33 (1974) that fire was a factor which released inhibition of germination. Recently, I tried the fire method which I carried out in the following manner: I sowed the seeds on the surface of a wet mixture of sand and peat. Then I crushed up three disposable paper towel sheets and set them on top of the pot and lighted them with a match. After the flames died down, I watered the pot thoroughly and observed the hot surface steaming. About three weeks later, I observed the first seedlings growing and several more popping up each day for several months thereafter. These were transplanted into the same system as for B. liniflora. Watering should be limited and the plant grown on the moist side but never overly wet. As the plant grows larger toward maturity, it should remain almost dry between waterings. This species also enjoys a very sunny, warm location throughout most of the day. Propagation can also be performed using large root cuttings which yield small green shoots. However, these cuttings are very susceptible to black rot and so this method is not as reliable as the above.

BRIEF OBSERVATIONS ON NEPENTHES MIRABILIS

by Bill Hanna:

A nurseryman up in the Queensland state of Australia wrote to me the following notes about Nepenthes mirabilis. The area known as Cape York Peninsula is as large as Victoria, but here and there in suitable wet boggy places one comes across N. mirabilis. I have not seen it growing further south than 150 miles from Cape York, but then I have not been looking for it and perhaps it does not occur further south. It does not seem to be fussy about location, growing as it does sometimes right beside a beach or 50 miles inland. But what it appears to demand in Australia is a boggy piece of ground, in contrast to New Guinea where I have seen it growing in areas which seem to have set as hard as cement on steep mountainous slopes around Bulolo. Also, it can be found growing in the blazing sun with no shade at all, when the whole plant takes on a reddish hue and the plants remain quite short; or it may be seen on creek banks where it struggles up the broadening trees to a height of 50 feet. These, I imagine, must be very old plants. The only preference it seems to express is that it requires a very poor growing medium, if it is to produce its very variable pitchers which sometimes are as long as twelve inches.

by A. C. Woodrich:

In Palau, I found these remarkable plants growing commonly and very frequently in disturbed areas of rough path-road running from the village dock to the village abai (community center building). Also, I found plants in the low, cool rain forest and on some road cuts and ditches near the village of Imeelsub near the southwest end of Babelthaup Island (largest island in Palau), Western Caroline Islands.

The local name is Melillik which has no translatable meaning, or Ollenemel a vchll (rain teapot). The "Rubaks" or wise old men who live in this village told me that the stem was used medicinally when pounded to extract juice which is added to coconut milk and drunk for an unnamed ailment. They recognized three types of N. mirabilis: red,green and white pitchers (apparently due to differing light levels). It is interesting that they did not know that insects provided food for the plant.

The smaller, younger plants were growing on road cuts, banks and ditches, while the larger plants (pitchers to about 7-8-9 inches) were growing in open grassy road margins with much grass and sedges to about 2-3 feet in height, sometimes entwining for support. They were associated with many ferns such as Gleichenia linearis, Lycopodium cernun and Lygodium scandens. Larger plants climb nearly to 6-7 feet in small shrubby trees of Melastoma malabathricum with the fruiting stalks even exceeding the height of this tree. The soil is a reddish clayish adobe type with rainfall averaging 150 inches or more a year. The plants grow in poor soils and disturbed areas and especially in savanna grasslands which are burned yearly due to negligence, children, etc.

VEGETATIVE REPRODUCTION IN FLYTRAPS

by Jan Hooft

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Vegetative reproduction by means of plantlets originating from modified floral parts in sundew (Drosera rotundifolia) has been reported from time to time and is discussed at length by Lloyd (1942) in Carnivorous Plants. In addition Lloyd discusses the formation of plantlets derived from adventitious buds formed on petioles and leafblades of sundews.

There are scattered reports of field observations concerning specimens of Venus' flytrap (Dionaea muscipula) with scapes bearing numerous plantlets. We have made several field collections of such plants, and have observed the phenomenon in cultivated flytraps in our greenhouses.

In 1969-1972 we successfully induced formation of adventitious buds on the excised petioles of Venus' flytrap and sundew. We were able to cultivate the resulting plantlets, many of which developed into fine specimens.

Floral Modification. Green, cupshaped, modified sepals surround each "plantlet" which apparently consists of modified stamens, carpels, and perianth parts. Often, in other specimens only one flower on an elongated pedicel will show modification, while the other floral buds are aborted. From our observation, these plantlets in inflorescences do not originate from seed or from embryos developing in the ovulary; they are vegetative in nature. We have found such modified flowers in May when flytraps are just beginning to bloom.

Adventitious Buds. In the spring of 1969 several small plantlets resembling Venus' flytrap seedlings were found in trays of mature flytraps in our greenhouse. These plantlets measured less than 7 mm. in diameter. The mature plants, grown from field collected rhizomes ("bulbs") had not yet produced flowers, and thus could be ruled out as a seed source. Likewise, flytrap seed could not have been present in the horticultural peat moss used as a planting medium.

A source for such plantlets was discovered when we located a partly decayed leaf which showed three minute buds on the wing of the petiole. In time one of these buds developed into a plantlet resembling a young seedling. This phenomenon has since been observed numerous times in our greenhouse.

In 1971 and again in 1972 we were able to induce formation of adventitious buds on excised leaves placed in a moisture chamber. Several of these buds developed into plantlets, which eventually grew into healthy well developed specimens.

The moisture chamber consisted of a covered culture dish partly filled with wet vermiculite. Other inert sterile material may be substituted for the vermiculite. Mature leaves selected from healthy greenhouse-grown plants were cut as close to the bases of the petioles as possible, and the traps were removed. Thus, only the winged petioles were used. The petioles were thoroughly washed and surface-sterilized in diluted (1:1) S.T. 37 (hexylresorcinol), a common antiseptic. Prepared petioles placed on top of the wet vermiculite remained fresh for as long as two months.

We placed the chambers containing the petioles on a windowsill. The petioles were protected from direct sunlight with paper. Other chambers placed on a rack equipped with fluorescent lights proved to be equally productive. After about a month small buds formed close to the rib on several of the petioles. Complete leaves with minute traps formed after about two months. The plantlets did not produce roots until decomposition of the original petioles was well advanced.

The formation of adventitious buds was also observed on transplanted rhizomes. At the end of the 1971 growing season, all plants that had not grown to desirable size or shape were uprooted, and all leaves and roots cut off, leaving only the short bases of the petioles attached. These rhizomes were transplanted into fresh growing medium and placed in a cold frame. The following spring the flats containing these rhizomes were placed in a cool greenhouse. Within weeks numerous buds formed on the petiole bases surrounding the rhizomes. A total of 180 plantlets were collected and transplanted.

The factors involved in stimulating formation of adventitious buds in flytraps are not understood. However, certain stress factors seem to be involved, such as temperature extremes and separation from the apical meristem. Buds will readily develop into plants when conditions are such that the injured or separated leaves survive in a more or less fresh condition for a long enough period of time. In a wet sphagnum bog such conditions may be met.

THE SOILS OF THE HUNTER VALLEY

by Bill Hanna

Blackbutt Reserve is located within ten minutes drive of the central business district of Newcastle and is approximately 375 acres in area. Within this reserve, two species of carnivorous plants grow. The genus is Drosera and the two species are auriculata and peltata. To generalize, Drosera auriculata is found at the top of the hills and on well drained slopes, whereas Drosera peltata is found at the bottom of the slopes where conditions tend to be slightly more moist. One can find mixtures of both growing together.

In the following passage, I have attempted to describe a soil profile typical of the area where these plants are found. The soil type itself is podsolic.

The soil profile was taken at an old mine shaft in the Queen's Road area of Blackbutt Reserve. A good soil profile was easily obtained for the first fifteen feet. The typical vegetation of this area is mainly tick bush with occasional gum tree. Due to the presence of one of these gum trees near the pit head, root penetration from this tree could be seen to a depth of 15 feet. The first two feet was gray clay. The surface of this clay was liberally covered with coarse angular pebbles ranging in size from 7 x 4 inches down to 1/8 inch in diameter, consisting of weathered ironstone, sandstone, and chert. The majority of the pebbles were on the surface but some were found scattered through the cross section.

In the three foot depth area, there was well weathered shale, yellow-brown in color, its texture granular and ranging in size from a two-inch piece to a speck with some pieces of ironstone scattered through this layer. At the four foot level the shale is now black to black-brown, probably due to the action of humic acids. This shale is extremely brittle and the presence of some iron platelets can be observed. In the rest of the layers the soil type was mostly green-brown chert followed by bands of brick-shaped chert.

MISSISSIPPI FIELD TRIP

by Robert Folkerts

Growing and caring for carnivorous plants has been a rewarding experience for me, but I could not help wanting to go out and observe first hand how they actually grow and function in the wild. Early in November, 1974, my chance came, and I find it difficult to express how wonderful it can be to see some of the plants you pamper and nurture in glass houses growing by the thousands in their natural environment. Along highway 90 about ten miles out of Pascagola, Mississippi, we found a spot mentioned in Randall Schwartz's book Carnivorous Plants. For the short time available to us for exploration, much insight was gained into how these plants fit so well into nature's plan.

Plants seen from the road were, of course, the first things to be investigated and were recognized as colonies of Sarracenia leucophylla, also known as Sarracenia drummondi and sweet trumpet. There would be anywhere from two or three plants to several hundred bunched loosely in a given colony, and colonies seemed to be clearly separated. Most notable to me at first, aside from the sheer beauty of these plants, was their remarkable diversification of coloration and pattern even within single colony groupings. Many lids were predominantly white with almost no venation or red coloration, some had mostly red venation, while still others had both red and green patterns. At least one specimen had a snow white cap with a red border around the edge. Variation within leucophylla species seemed almost endless and it set me to wondering how so many genetic combinations could ever be clearly separated into one classification. Specimens waist tall were predominant (measuring approximately 30 inches from base to tip). Pitchers taller than 30 inches were not nearly so numerous, and lesser forms were almost hidden from view in places because of tall grass. One specimen of about average height had a remarkably large opening, almost 3 inches across. Great efficiency of insect trapping mechanisms became apparent because so many of the pitchers were literally bursting at the seams with insect carcasses.

Walking further, we began to notice that grass was not as thick in some places, and in one of these thinned out areas we noticed a small clump of Sarracenia alata and others. These pitchers were roughly the same average height as S. leucophylla but variation is even more pronounced in this species. Color ranged from solid yellow-green to solid rusty maroon. Some had veined lids, green with bright maroon venation, some with veined throats, still others with veined networks down the sides. These pitchers did not appear as plentiful as S. leucophylla, but one thing that made them seem more scarce could be their lack of brighter colors. Hood structure also varied widely, some tall with deep convolution, others shorter and relatively smooth. There is a strong likelihood of much introgressive hybridization with S. leucophylla.

Wondering if more types of carnivorous plants grew in this area, we began looking closer to the ground in search of smaller types. Nearby we saw the head of a Sarracenia psittacina sticking out of the grass. It was about average size (approximately six-inch

pitcher length), but one specimen (which I later found out is endemic to this state) must have been over a foot and a half in diameter. Being mostly out in the open, shielded only by grass, pitcher color was deep green, spotted white and veined red.

While moving grass away from around Sarracenia psittacina, another discovery was made. Sundew (Drosera capillaris and D. brevifolia)were covering the ground! The latter were all quite small (no more than one inch diameter) and bright red in almost direct sunlight, sparkling like rubies against the jet black soil. Many ditches snaked through the area, and all along the sides and bottom of these, Drosera were so abundant we could not walk without stepping on them. Butterwort (Pinguicula lutea) were easy to spot, being bright yellow-green. Two or three specimens were collected but because of a lack of a suitable digging tool, I had to almost tear them out of the ground and survivial is doubtful.

Across a shallow ditch and a little further ahead, we came upon a most remarkable location where every type of carnivorous plant to be found in this area was noted. Sarracenia purpurea found here were all deeply red veined and most beautiful. Here we also found one most spectacular specimen at least eighteen inches across! Pitchers on this plant measured nine inches from base to tip. Spread out hood measured three and one-half inches across and the pitcher part held over four ounces of fluid. Many insects were found inside ranging through ants, moths, flies, and even spiders.

Natural cross breeding was well illustrated in a specimen physically located between a stand of Sarracenia alata and Sarracenia purpurea. This plant appeared to be made up of about 50% of each parent plant but reminding me most of a Sarracenia purpurea with greatly enlarged and elongated upright pitcher structures. This being the most unusual example observed on this trip, I did take a sample, but made certain to leave enough rhizome to insure survival in the following season.

Fall may be a good time to collect specimens but was not the best time to observe many of these plants. Greatest evidence of flowering observed was that of dried up seed pods, most of which had already burst open and dispersed their seed. Sarracenia leucophylla seemed to be the most productive flowerwise, and as many of these pods were collected as practical for Bob Ziemer's seed exchange service.

Looking over the general terrain of the area, it soon became apparent that these plants lived in a very narrow ecological range. Sarracenia leucophylla did not seem to be particular at all, but others like Drosera and Pinguicula seemed to populate very well defined areas. These areas were not plainly set apart from others except for possibly shorter grass in places. Soil was very black, soggy and surprisingly packed. Digging revealed concentrations of roots near the surface, sometimes quite thick with approximately 10 to 20% fine white sand mixed in. PH readings on a soil sample brought back read 6.4, acid as expected. Most notable was the fact that although the soil was very wet, it was not waterlogged. In fact, any areas that would be submerged for any length of time were void of carnivorous plants.

Tall grass and weeds (two feet tall in places), although proving a hinderance to exploration, probably serve smaller plants well by providing a less hostile micro environment. Several advantages come to mind: (1) Drosera and Pinguicula are provided shade from the constant relentless sunlight which might burn delicate leaves. (Some sundew were noted growing under very dense matted coverings of grass.) (2) Delicate mucilage droplets are protected from drying wind and other drastic humidity changes, thus enjoying greater average humidity than they wouldin the open. (3) Drosera, which are especially sensitive to over-stimulation, find some protection from wind-borne debris or raindrops under this natural umbrella.

During somewhat limited preparation, Jim Davis and I gathered a number of items we thought would be of use, but as things turned out, we were most unprepared. Anyone contemplating a trip into the wild in search of our bug-eating friends might benefit from a list of things we missed. Planning is most important. Once you locate an area, and if time permits, make a list of things to accomplish and try to allow enough time to do so. Of course individual requirements may vary widely such as photographic or specialized study, but most of these items can be of some use in one way or another. Here is our list: appropriate clothing (it could be extremely hot and muggy depending on what area of the country you go bogging--count on getting dirty); high top boots; snake bite and first aid kit; water (for drinking and washing specimens); knife; photo equipment (as per individual requirements); compass (if there is any doubt about finding your way back); digging tool (for specimen collection); plastic bags (for specimen collection); measuring device (optional); pH kit (optional); notebook and pencil (for taking notes); maps.

Other locations around the country may not have the variety and number of plants we encountered in Mississippi, but if the opportunity presents itself to go on a field trip, don't turn it down. It will be greatly rewarding if for no other reason than to see Nature at her best.

SPECIAL NOTICES

Triarch Incorporated (Botany Department, P. O. Box 98, Union Street, Ripon, Wisconsin 54971) wants to purchase some living or fixed materials of Drosera for microscopic slides of the leaf hairs. If you can supply them from your collection, please write to Dr. F. L. Hockman, head of the department.

Tote Em in Zoo, a commercial CP source, has a new mailing address: 5845 Carolina Beach Road, Wilmington, NC 28401.

N.J. author looking for solid data on use of Sarracenia purpurea (or any other Sarracenia) by Indians--especially New Jersey area Indians (Delawares, Lenni Lenape and subtribes) as medicinal plants. Suggestions greatly appreciated. Send to Pete Johnson, 137 Welton Street, Second Floor, New Brunswick, N.J. 08901.

CPN BACK ISSUE REPRINTS -- In the March issue, we mentioned that one of our subscribers had undertaken copying back issues of CPN and was offering these for sale as his own private enterprise. He is copying another batch but wishes to wind the whole thing up as promptly as possible. While there is still a chance to obtain these back issue copies, place your order as soon as possible because this will be the last reprint by him. All prices are postpaid surface: U.S., Canada and Mexico--$6.00 per volume (four issues). Foreign--$7.00 per volume. Single issues--$2.00 U.S., Canada and Mexico; $2.25 each, foreign. Send all orders with payment to: A. ROGER KIRBY, Route 3, Box 470, Granite Falls, NC 28630.

CARL FORST writes in to inform us that Thompson & Morgan of Ipswich, England, have this year opened a branch in New Jersey to handle North American orders. In their 1975 catalogue, they list Nepenthes khasiana seed (stock no. 7254) at $1.95 per packet. Amazingly, they have also featured this year for the first time "New Hybrid Sarracenias-Mixed" (stock no. 2638) at $1.35 per packet of approximately twelve seeds! The address for the catalogue which is free is: P. O. Box 24, 401 Kennedy Boulevard, Somerdale, N.J. 08083.

Many people write to us asking for a source of live sphagnum moss. We know of two sources and would like to know more if anyone would like to write us. One is Arthur Allgrove, North Wilmington, Mass. 01887, who sells it in units of one-third cubic foot. Another is John Glennon, Route 1, Box 231, Eureka, CA 95501, who is willing to exchange CP for some.

For those who are interested in trying to grow Nepenthes khasiana from a root cutting for $10.00, inquire from Jerry Horne, P. O. Box 381675, Miami, Florida 33138.

RECENT LITERATURE

Case, F. W., Jr. and Case, R. B.: Sarracenia alabamensis, a newly recognized species from central Alabama. Rhodora 76(808): 650-665, 1974.

Previously thought to be members of various Sarracenia species in a long and tangled history, the author puts forth a case for separate species designation of these interesting disjunct populations. We have one tactical criticism: we wish the two plates of rather poor herbarium specimens could have been replaced by four half pages of photos of live plants and/or a good species composite drawing.

Chequer, Graeme: Orchids in Plastic. American Orchid Society Bulletin, December, 1974 pp. 1063-1065.

This article deals with the technique used by the author to embed orchid flowers in clear polyester plastic. This method would allow CP enthusiasts to make permanent preserved specimens of species that they have collected, but that refuse to grow indoors.

Cruise, J. E. and Catling, P.M.: Drosera species in Ontario. Ont. Field Biol. 28(1) pp. 1-6, 1974.

The authors describe four species of Drosera: rotundifolia, linearis, anglica, and intermedia and their habitat in Ontario, Canada.

Durand, R. and Zenk, M.: The homogentisate ring-cleavage pathway in the biosynthesis of acetate-derived naphthoquinomes of the Droseraceae. Phytochemistry (Oxf.) 13(8): pp. 1483-1492, 1974.

Photosynthesis experiments with radioactive carbon dioxide established that of sixteen Droseraceae species, Drosophyllum lusitanicum incorporated the highest amount of label into the dye, Plumbagin. Labeled Tyrosine fed to the latter species also incorporated label into Plumbagin with high efficiency. The degradation of tyrosine to acetate by Drosophyllum is not due to epiphytic bacteria since the same results were found in sterile grown plants and sterile suspension cultures.

Franck, D. H.: Early histogenesis of the adult leaves of Darlingtonia californica. Am. J. Bot. 62: 116-132. 1975.
A microanatomical and histologic study.

Gilchrist, A. J. and Juniper, B. E.: An excitable membrane in the stalked glands of Drosera capensis L. Planta (Berl.) 119(2): 143-147. 1974.
The plasmalemma adjacent to the tracheid becomes highly modified when milk proteins are fed to the gland of D. capensis. The surface of the membrane grew and evaginated outwards forming a bleb into the cavity of the tracheid and pinched off. In this manner amino acids are shunted quickly from the digestive gland to the tracheid and down the plant by a form of stimulated "exocytosis."

Lowry, J. B.: Effect of drought on Mt. Kinabalu. Malay Nat. J. 26(3-4), 178-179. 1973.
The author discusses the effect that severe drought had on plants growing on Mt. Kinabalu, North Borneo, especially on Nepenthes lowii.

Standley, Paul C.; Williams, Louis; Gibson, D. N.: Flora of Guatemala. Fieldiana Bot. 24 Part 10(3/4) 153-466. 1974.
Three genera of the Lentibulariaceae, giving keys, synonymies, vernacular names, uses, descriptions and illustrations are given in this article along with plants from seven other families that are not carnivorous.

Toekes, Z.A. and Woon, W.C. and Chambers, S.M.: Digestive enzymes secreted by the carnivorous plant Nepenthes macfarlanei L. Planta (Berl.) 119(1): 39-46. 1974.
At least two proteases are present in the secretion of pitchers of N. macfarlanei, a major one with a MW of 59,000 and a minor one with a MW of 21,000. The major one is termed Nepenthesin and had strikingly similar properties to the animal enzyme, pepsin. Lipase activity was also demonstrated.

(Because the following article was originally in Spanish and we thought it would be of great reader interest, Joe Mazrimas has made a more extensive summary than usual.)

Brewer-Carias, Charles: Observations on the ecological niche of Heliamphora. NATURA No. 48-49 (1972) and Carnivorous Plants of Cerro de la Neblina. NATURA No. 6, 17-26 (1973)
IN SPANISH

These two articles were written by Dr. Brewer-Carias, a well-known naturalist and photographer, who traveled with G.C.K. Dunsterville and Julian Steyermark in 1970 accompanying a team of government surveyors to the extreme southern border of Venezuela on the border with Brazil where they found a mesa of sandstone rising some 3000 meters (10,000 feet) in elevation above the hot Amazon forest floor. This area is so primitive that it was not until 1953 that Basset Maguire and other botanists explored the area geographically and published their findings in The Geographical Review 45, 27-31 (1955). Because these strange mountains were constantly shrouded in clouds and mist, the name Highland of the Mists was given to this area.

From their campsite at 2000 meters (about 7000 feet), Steyermark viewed a vast variety of plants with a steep degree of endemism which is often characteristic of adaptations to extreme altitude under the influence of extreme environment over millions of years. Brewer-Carias made an extensive photographical study of the ecology taking some 1500 plates in the hopes of making a graphic record of some mechanisms that carnivorous plants use to capture insects in the natural state.

The soil in this area consisted of a thick vegetal layer of peat about 4 meters (12 feet) thick. It was acid in pH, poor in nutrients and cold in temperature which favored carnivorous plants of the genera Drosera, Utricularia and Heliamphora. Utricularia humboldtii was found growing in water that accumulated in the vase of the giant bromeliad genus Brocchinia. This plant grows to about six feet in diameter and the Utricularia can be found growing between the leaves of the plant in lightly shaded spaces. U. humboldtii has circular leaves of 3-7 cm. in diameter (1-2.5 inches) with stems that grew up to 40 cm. in length (17 inches). It has showy, large, beautiful rose-colored flowers.

Drosera roraimae was found growing on soil rich in sand and humus in locations which were constantly wet and exposed to the direct rays of the sun. This species grows in a small rosette some 3-4 cm. in diameter. Its brilliant red leaf color gives the impression that someone has spread fresh strawberries over the area.

The species Heliamphora is endemic to the region of what is called the Pantepui or high mesa of the Bolivar and Amazonian Territories. In the Highland of the Mists, the scientists found two kinds of Heliamphora plants which probably are distinct species that occupy distinct habitats. One lives in a marshy ground embedded in it so that its opening is perfectly level with the surface in the manner of a little crater. The other species grows in sufficiently dry ground that is slightly inclined and forms a pitcher that reaches about 1.5 meters (almost 5 feet) in height which must be supported by the surrounding vegetation. The following observations are on this species. First, he observes the function of the various modified parts of the plant pitcher whose individual structures all contribute to the overall function of trapping

and digesting insects. The cap secreted the nectar to attract the mosquitoes in large numbers. Its odor and sweetness had an irresistable attraction for insects. The exterior of the pitcher body feels like velvet with V-shaped hairs that facilitate insects trying to climb to the top. Meanwhile, the hairs in the interior portion pointed downward with the result that insects inside the opening were not permitted to escape. Hairs with different structure and stiffness were observed in different areas of the pitcher wall to serve various functions.

Observations were also made on the maintenance of the water level within the pitcher. It seems that the level of water established itself about 1 or 2 cm. below the pore in the side of the pitcher. Using some simple experimental methods, the author determined that certain long hairs caused the water to drain out by capillary action to the outside wall and run down the side. This drainage was aided by the elongations of the base of the leaf which extends exteriorly up to the fissure and acts like a siphon which empties the water inside until it establishes a new level.

Finally, one interesting observation was made concerning the digestive process which is believed to be mainly bacterial in nature. In the base of the pitcher, many insect carcasses were found in a thick and viscous mass. It was semi-liquid in consistency, and swimming in this mass were found various white nematodes 1 cm. long by 1/2 cm. wide. These nematodes lived between the hairs of the pitcher walls and the author postulates that these creatures might live symbiotically with Heliamphora and that in digesting the insects they excrete some elements utilizable by the plants.

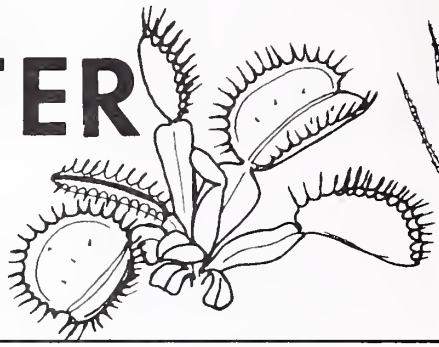
ADDITIONAL READING

Ort, Paul: Expedition of the Brazilian-Venezuelian Boundary Commission to Cerro de la Neblina. Garden Journal 15, 199-203. 1965.

Maguire, Basset. Geographical Review 45, 27-51. 1955.

Maguire, Basset. Geographical Review 49, 566-569. 1959.

CARNIVOROUS PLANT NEWSLETTER



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CO-EDITORS: D. E. SCHNELL, RT. 4, BOX 275B, STATESVILLE, NC 28677, USA
J. A. MAZRIMAS, 329 HELEN WAY, LIVERMORE, CA 94550, USA

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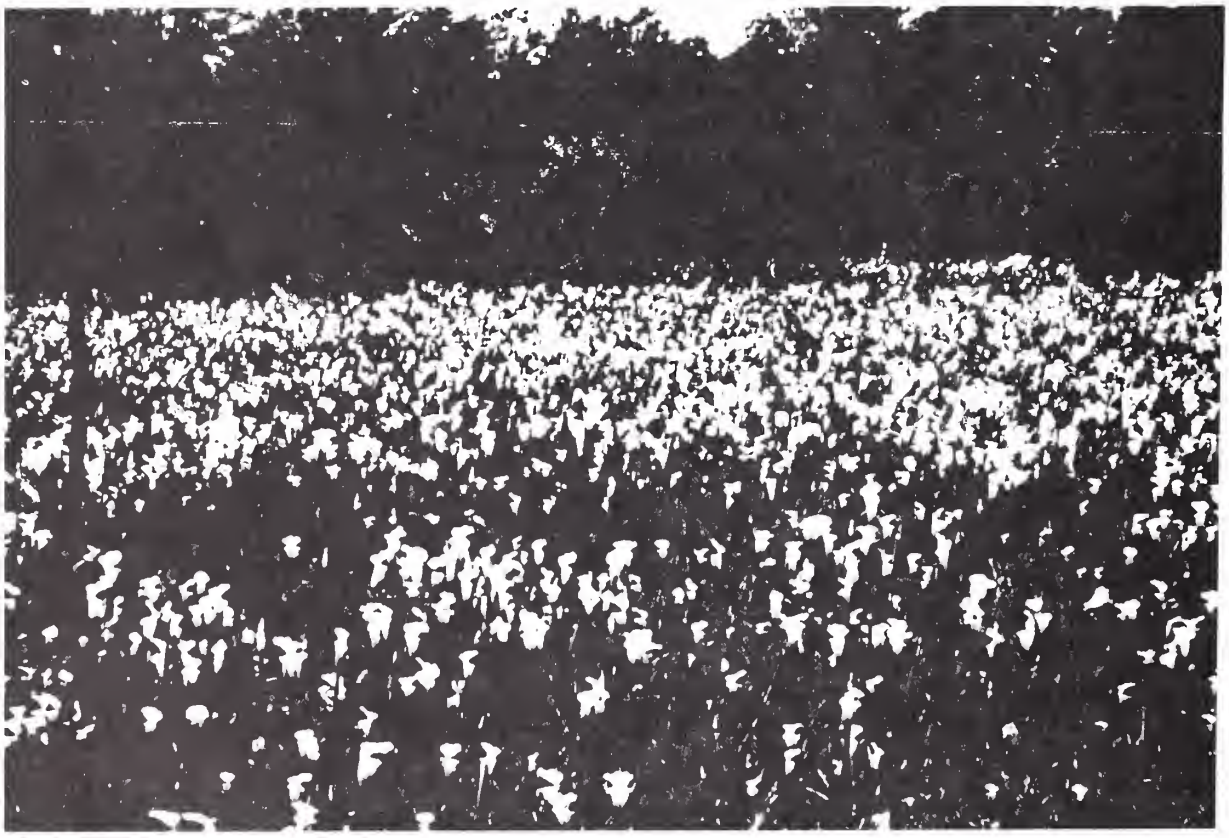


SARRACENIA LEUCOPHYLLA

Baldwin County, Alabama

DIONAEA MUSCIPULA ↓

TENTACLES OF DROSERA ROTUNDIFOLIA →

These two photos by ROBERT FOLKERTS

UTRICULARIA CORNUTA

Boiling Springs Lakes, N. C.

RENEWAL NOTICE

It is that time of the year again and the annual unpaginated renewal notice and form is appended to this issue. This will be the only renewal form you will receive; we do not send out individual notifications or continuing reminders in order to keep the mechanics--and ensuing expenses--of handling subscriber records to a minimum. So send in your check for the appropriate amount along with the completed form to either one of the co-editors. (Some of you who have sent in subscriptions for two or more years and are covered for next year can, of course, disregard this notice.) Please have all renewals in by January 15, 1976. We ran short of issues to take on additional subscribers during this mid-year and plan a much larger printing next year, but late renewals could still conceivably miss the boat in spite of the larger printing. CPN is growing very rapidly as word gets around and a day seldom goes by without one or more subscription requests in the mail.

Unfortunately, inflation has again caught up with us and we are forced to another subscription rate increase, the present rates having held for two years. By the time you get this issue (mailed under the wire, so to speak), the long promised 30% postal rate increases will no doubt be in effect and these will pinch us a little in mailing out the December issue since we carefully plan the subscription rate to just cover all expenses. Along with the postal rate increase, printing and paper costs will likely rise, and we will be using a mailing service next year. All in all, CPN will still be a bargain at the new rates, albeit a relative bargain in terms of worldwide inflation. However, informal comparisons by one of us has shown that we put out more pages of "hard" information for the price (even the new one) than all other newsletters of similar nature but different subject matter. We average 70-80 pages a year of 30% reduced print size, whereas one newsletter we know of--with a few small ads--offers only 48 pages of standard size type per year and the rate is $6.00, compared to $3.00 we are asking for next year.

NEW SUBSCRIBERS

RODNEY BROWN (Box 5, Wrangell, Alaska 99929).
STEVE KASPER (23700 Oak Glen, Southfield, Michigan 48075).
MS. DEBORAH S. DALTON (1507 Broad Avenue, Charlottesville, Virginia 22903).
A subscription previously attributed to Ms. Geri Peterson should instead be for Mr. JEFF JEFFERSON (185 Hall Street, Apt. 406, Brooklyn, NY 11205).

We have a very short list of new subscribers this issue because the subscription list for the present volume is already closed with 450 subscribers. Any further new subscriptions will be put off for 1976. We wish to keep subscriptions by the volume and we have already used our supply of issues No. 1 and No. 2 of this volume. There will be a much larger printing next year in order to accommodate all renewals and new subscribers.

NEWS AND VIEWS

ROBERT M. HAYNES has some comments regarding the relative economy of Gro-Lux Wide Spectrum fluorescent tubes versus regular Gro-Lux: "The former cost me $2.50 each including tax and a 15% discount for buying a case of six while the regular tubes cost nearly $5.00 each. Many people I have met have not heard of the newer Wide-Spectrum Gro-Lux and this information may be of interest. The Wide Spectrums are available in 4, 6, and 8-foot sizes that I know of, and perhaps smaller sizes. Sylvania is the manufacturer and the code number is F40-GRO-WS."

JOE MAZRIMAS has found a technique for obtaining viable pollen consistently from Heliamphora flowers. The problem seems to center around sufficient drying of mature anthers so dehiscence can take place. He removes the anthers from the flower when they are plump and yellow-green and simply dries them in a warm place until the anthers turn bright yellow. The anthers are then broken up and there is a copious pollen yield; the pollen is viable as indicated by mature, germinable seed obtained from flowers pollinated with the material.

JOHN LINDQUIST has written that he has just completed his 215 page thesis, "Bacteriological and Ecological Observations on the Northern Pitcher Plant, Sarracenia purpurea L." We hope to have the opportunity of reading it.

BILL HANNA has sent us some information about the Australian magazine called Australian Natural History 18 (1) 1974 which features a five-page article on native CP including pictures of Nepenthes, Cephalotus, Drosera and Utricularia. Back issues can be obtained from: The Australian Museum, P. O. Box 285, Sydney South 2000 Australia. He thinks it will cost approximately $1.00 plus postage U.S. currency.

"Man is the great leveler" says an article on how many plants and insects are being

endangered and threatened with extinction. Several CP such as Dionaea and Darlingtonia (in Oregon) are in real danger of becoming extinct if collectors aren't stopped. The Los Angeles Times carried an article on May 23, 1975 written by Robert Jones which lists thousands of plants and animals that a recent survey by the Smithsonian Institution considers to be threatened with extinction. We would like to thank BOB HANRAHAN for sending this article to us and making us aware of the fact that many CP are rare and becoming rarer due to man's efforts to urbanize the environment.

DAVID HESTON sends us a note to relate to us another source for live sphagnum moss: Peter Pauls Nurseries who sell it by the pound. The price varies depending on where you live. He also adds that Maryland subscribers can visit the Brookside Botanical Gardens in Wheaton which features an excellent exhibit of CP in terrarium.

TREVOR KUCHEL writes in to tell us of his problems with mouse trouble in his glasshouse. They are eating off the pitchers from his Nepenthes plants. He set some traps and caught some of them but many of them are still getting away with the bait without getting caught. Some of these critters are taking the bait and making neat piles around the Sarracenia plants with this being repeated again each morning after he went through and tidied up all the plants each day. He complains that his glasshouse was beginning to stink with dead mice everywhere. Apparently, the mice are avoiding getting trapped in his pitchers although they seem to be large enough to drown them.

BILL HANNA sent us the information that we can add another book to the growing list of CP books. It is an elementary treatment of CP and is titled Plants That Eat Animals by Collin Threadgall. This interesting and profusely illustrated book can be obtained from the publishers: The Bodley Head, 9 Bow Street, London, England WC2E 7AL. It sells for approximately $5.00 U.S. currency. Another book that mentions CP is called Wild Flowers of Thailand which features three plants with illustrations. They are Drosera burmanni, Nepenthes thorelli, and Utricularia flexuosa. The U.S. price is $10.00. It has 200 pages with 142 color photographs with full descriptions of all plants mentioned. There are discounts available on multiple orders of five copies. More details can be asked from Dr. Tem Smitinand, Forest Herbarium, Royal Forest Department, Bangkok 9 Thailand.

Bill also relates a few excerpts from a letter he received from an orchid hunter in the tropical forests of Queensland, York Peninsula, Australia. "A mate of mine here who is an orchid grower joined me to the foot of Mt. Bartle Frere on a very wet and washed out forestry road. We were in a Toyota with four-wheel drive and had to winch ourselves out of the bog four times to get there. But it was worth going there for the scenery. There are falls there in the creek 900 feet high in a straight drop as it goes over the escarpment. Drosera schizandra grow along the bank about a mile back. We had lunch there amid the leeches which crawledall over our legs and even got into our boots. I hate those things! We have never seen D. schizandra growing anywhere else. They grow in the rain forest and seem to prefer a lot of shade together with wet conditions. Drosera spathulata and indica will grow in the open and don't seem to mind getting plenty of sun; in fact, the spathulata are only colored red in the sun or otherwise they stay green. Both plants grow where the ground is wet from soaks, but the indica don't seem to demand such wet conditions as the D. spathulata." (These are the joys of hunting for CP!)

Bill also mentions another book called Off the Beaten Track which has the Cape York Nepenthes in it. It has two full-page color photos of them. The Leyland brothers author this book as well as a series of interesting adventure-documentary films. One of the films describes their trip through the York rain forests showing some hairy trips taken with Land Rovers floating down streams with the current and building roads as they went along.

JOHN TURNBULL has sent in the following growing tip: "Large waterproof trays for housing potted CP can be constructed inexpensively from marine grade plywood or particle board and waterproofed with fiberglass kits sold for car body repair. The fiberglass cloth is used to seal the joints only. For a 4' x 2' x 6" tray, three square feet of fiberglass cloth and one quart of fiberglass resin was required. Several coats of fiberglass resin are then applied to complete the sealing and waterproof the wood. The fiberglass should be allowed to cure for several days before water is added. This type of tray is ideal for indoor light setup because the large water surface area helps to maintain high relative humidity, and the size can be chosen to make best use of available space rather than relying on commonly available plastic tubs or aquariums." Incidentally, John's letter bore a Canadian stamp with a nice picture of Sarracenia purpurea on it!

ROGER KIRBY has found that a New York publisher has reprinted Darwin's book Insectivorous Plants. Write Ames Press, Inc., New York City 10003. The cost is about $12.00. Roger also informs us that he still has a few copies of past CPN volumes left for those who wish back copies for their CPN collection. Particulars are on page 35 of the last issue (Vol. IV, No. 2, June, 1975).

DON SCHNELL has some comments on the list of threatened and endangered CP species so well excerpted and presented from the original Smithsonian list in the Short Notes section of this issue by David Lane: "This listing and the possible conservation actions as a result of it are long overdue. The listing as presented hereis, of course, from an overall viewpoint and the more detailed state-by-state listing to be published by the Government Printing Office will show a far more precarious picture. For instance, only a handful of Sarracenias are listed as endangered or threatened overall. But in rather large local areas such as eastern North and South Carolina, I would list all Sarracenia species and subspecies as endangered, while many of these same species still occur over large areas farther south along the Gulf. Even from the overall viewpoint, I think the following should be added to the endangered list (the more serious category): Drosera linearis, Pinguicula primuliflora, Sarracenia rubra ssp. jonesii (S. rubra as a whole is "only" threatened) and S. purpurea ssp. purpurea f. heterophylla."

Don continues: "I would certainly agree that habitat destruction, so rampant and efficient in this age, is the chief threat to most CP. But commercial gathering and careless vandalism provide the coup de grace to many formerly fine locations. For instance, we have good evidence that a commercial supplier has recently been responsible for a wholesale raid on a good stand of S. oreophila which was located in an Alabama state park (!) and which was completely wiped out during the collection. This one collection effort reduces the known good stands of rare S. oreophila by 25%, a huge chunk! While in the Green Swamp area of North Carolina a few weeks ago, I noticed a row of four men with burlap bags crisscrossing a savannah in the manner of--and with the same efficiency--a squad of cotton harvesters of a century ago, going row by row and literally plucking Dionaea and Pinguicula like so many fruits of labor. Around the corner on another road, a partner (no doubt) was actually pitchforking sphagnum from a stream slough into the rear of a full-sized dump truck, thus damaging severely one of the few remaining microareas for important plants that once had acres and acres to grow on. Thus, the idealistic aim of propagating endangered plants in botanical gardens in order to replace them into the environment eventually is certainly laudatory, but I am afraid somewhat myopic. One cannot replace into an environment that is no more, or that is such a small and tenuous area that it too will go under one day. No, I am afraid the well kept botanical garden collections and seriously maintained plantings by professional botanists and skilled amateurs alike, and possibly a few meager acres of preserves, will be the eventual end of many of our fine CP species. Ideals are fine as long as one still makes contingency plans for the often more likely if less desired outcome."

BRUCE HOGGARD writes: "Thought I'd drop you a line and tell you that my Nepenthes ampullaria is getting ground pitchers. When I saw you last August, you suggested that I cut off the top of the vine to force the ground pitchers out. Well, I didn't because they came out naturally. I have a feeling that very high humidity causes those little pitchers to come out although I have no control to check this with."

BARRY D. JORDAN sends in a note about a CP book by Bruno Schulz called Fleischfressende Pflanzen (Die Neue Brem-Bucherei: A. Ziemsen Verlag, Wittenberg, 1965.) It is brief (111 pages) but still reasonbly well written with some detail and in a not too technical manner. It offers a good account of CP and seems to be of more than passing interest to the CP enthusiast with a reading knowledge of German.

PETER PRAGER was looking through a book entitled Wildflowers of Western Australia by Kenneth F. Baker and found a beautiful picture of Drosera stolonifera in color and in bloom.

JACQUES HALDI sends us information on obtaining classic reviews of various genera reprinted separately from Das Pflanzenreich by A. Engler and L. Diels. Listed below are the reprints available with price in German marks (DM).

#26: Droseraceae by L. Diels. 1906, 136 pages, 286 figures, 1 map
ISBN 3-7682-2026-5 In German and Latin DM 40

#34: Sarraceniaceae by J. M. Macfarlane. 1908, 39 pages, 1 plate, 43 figures
ISBN 3-7682-2034-6 In English and Latin DM 15

#36: Nepenthaceae by J. M. Macfarlane. 1908, 92 pages, 95 figures
ISBN 3-7682-2036-2 In English and Latin DM 30

For more information write to: A. R. Ganter Verlag
Verlagsausleiferung
Postfach 14
Liechtenstein, Switzerland FL-9409

Call your local commercial bank to receive up-to-date exchange rates.

LYNN MACEY sent in some delightful cartoons about CP which came from a book called Gleeful Guide to Communicating with Plants to Help Them Grow by Will Eisner. We are always delighted to receive copies of either original cartoons or those printed in various magazines and newspapers. We already have a sizable collection and perhaps some day we can reprint the best from this collection in CPN.

SHORT NOTES

TAP WATER PURIFICATION BY REVERSE OSMOSIS

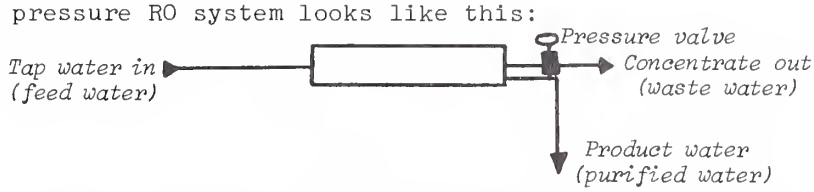
by Bob Hanrahan

Possibly the greatest obstacle for many of us to increase our CP collection is the problem and cost of obtaining mineral free water. It's not a secret that a majority of our plants naturally grow in pure water areas. (Ref. CPN Vol. 1, No. 1, p.6) Striving to duplicate the natural environment can require the use of high cost distilled or deionized water. This article will present an alternative for CP buffs in utilizing a fairly new water purification process called Reverse Osmosis (RO) to produce high quality low cost water. The cost per gallon will vary as to the purity of the tap water used, but generally will be less than 2¢ per gallon. A complete ready-to-use RO system is available for under $65.00 (U.S.)

In simple terms, RO is a process that forces water under pressure through a special membrane filter to remove 90-95% of all water impurities. There are two basic module types available; a low pressure module (operates with water pressure between 30 and 175 psig) and the expensive high pressure systems (200-600 psig). For our use, the low pressure modules are ideal as they work nicely off normal tap water pressure levels (60 psig).

Gallon per day (gpd) output or product flow, varies as to the design of the module and line pressure. Available modules produce 5, 15 or 25 gpd at 60 psig. Output will be considerably higher with greater pressure levels but make sure you don't exceed the specified maximum pressure. RO modules are easily ganged to meet just about any large requirement. I find the 5 gpd system more than sufficient for my use and find myself using it about four days per week.

Pictorially, a low pressure RO system looks like this:



To accomplish better than a 10 to 1 reduction in total ppm, 10 gallons of feed water are required to produce 1 gallon of product water. This feed-to-product ratio can be adjusted lower, but a sacrifice in ppm reduction is made. More important, the life of the module is really reduced. The concentrate water need not be totally wasted. I use it to supply my swamp cooler with water and the rest to humidify my greenhouse. With 400 to 500 ppm feed water, a module will last at least one to two years running continuously. Deviating plus or minus from this ppm count will either shorten or lengthen the life span.

To produce distilled quality water or better, a DI cartridge can be attached directly to the RO product water. Most CP like water low in salts with a ppm count of 30 or less. So if your tap water is much over 440 ppm and/or you do not have provisions for continual leaching of the soil medium, you should consider DI. DI cartridges are generally rated in grain capacity. You will have to convert your ppm count to grains to calculate the life expectancy of the DI unit and its operating cost. For me, it works out at about 2.4¢ to convert 35 ppm water (2 grains) to 0 ppm DI water. Without using RO first, the cost would be 24¢ per gallon, the advantage of RO is quite evident.

Two important factors must be considered before an RO or RO-DI system is contemplated:

1. The feed water must be chlorinated or a bacterial killing agent like chlorine must be injected into the module to kill any bacteria that could destroy the membrane. A few drops added weekly to the feed port will do this if your water supply is direct from a well or untreated. Fortunately, most public drinking water supplies (U.S.) are chlorinated but it is best to check with your local water company to be sure.

2. The total dissolved solids (TDS) of the feed water must be less than 1000 ppm and below a pH of 8.5. Actually a TDS of 1000 is considered undrinkable by the U.S. Government, so hopefully we need not consider this. Again, check with the local water company or check your water yourself with an inexpensive TDS test kit from a tropical fish store.

The convenience of having quality water available at all times and at a fraction of the cost of commercially distilled or deionized water makes the application of RO or RO-DI highly feasible and realistic for the CP hobbyist.

Glossary

ppm (parts per million)	A measurement in terms of solids weight, of any character, which are dissolved in 1 million equivalent parts of water. (8.3 lbs. solidsin 1 million gallons of water)
deionized water	Water that has gone through an ion exchange process to produce very pure water. Also known as demineralization. (Do not confuse with water softeners, they actually increase the total ppm.)
distilled water	Water that has been evaporated and recondensed. Produces water with a ppm count of less than 10.
grain per gallon	One grain equals 1/7000 lb. or 17.1 ppm = 1 grain per U.S. gallon. In metric, 1 ppm = 1 g per cu meter = 1 mg per liter.
conductance to ppm conversion	To convert a water conductance measurement (mmho) to its ppm equivalent, simply divide by 2. (Example: 40 mmho = 20 ppm.)

For those interested in specific elemental rejections from an RO system, I have included a report from a water testing laboratory that analyzed feed and product water from a 5 gpd low pressure module.

(Cations)	Feed (ppm)	Product (ppm)
Calcium	44.	1.
Magnesium	37.	0.8
Sodium	100.	6.30
Potassium	4.74	.11

(Anions)	Feed (ppm)	Product (ppm)
Carbonate	Nil	Nil
Bicarbonate	231.7	12.6
Sulfate	379.	32.0
Chloride	91.2	11.5

	Feed	Product
Hardness ($CaCO_3$)	262.2	5.70
Alkalinity ($CaCO_3$)	231.7	12.6
TDS	538.0	11.0

Special RO systems are available from: Agro Products, 9447 E. Artesia Blvd., Bellflower, California 90706. Write for current prices.

A TRIP TO ARTHUR PASS, NEW ZEALAND

by Jim Forrest

The day dawned clear and sunny, the weather report was good, but neither of these counts for much in what you'll find in the Alps. The main Divide is a divide in more ways than one, and particularly in relation to weather. Leaving Christchurch, you travel northwest along straight paved highways for thirty miles or so to the front ranges of the Alps across the intensively farmed Canterbury Plains.

The first range is climbed by Porter's Pass to a height just over 1000 meters (3000 feet) and a stiff climb too! The road winds for another 70-odd miles to Arthur Pass, skirting mountain ranges up and down, across stony riverbeds, and often alongside wide stony rivers which become raging torrents after rain or when a hot northwest wind melts the snow. The mountains are almost devoid of vegetation and are masses of moving rock--a tribute to one hundred years of burning and overgrazing.

We arrived at the summit which lived up to its reputation--it was raining for 100 meters on our side. The Pass is the center of a national park so some attempt has been made to preserve the vegetation. Alongside the road were small lakes and wet areas and it was here I looked for Drosera.

Drosera arcturi was here by the acre in full flower and plants that could be counted in the thousands. D. spathulata was present also, but not in such vast numbers. Both plants were noticeable for the brilliant red coloring backed by the white flowers--single in the case of D. arcturi. The plants were in some cases growing in sphagnum but in general just in a mass of peat, mires, roots, sedges, etc. The water level in the ponds was about 3 cm. (one inch) below the surface and this I presume kept the temperature for the plants down. In winter, the area will be frozen or covered in snow for months. I couldn't find D. stenopetala which is much more localized. No luck with Utricularias either. Some idea of the weather barrier can be gained from the fact that at the Pass rainfall is about 5000 mm. yet about 10 Km. away it is down to 800 mm. Further south, the contrast is even greater.

SEED

by J.A. Mazrimas

Growing CP from seed is a rewarding experience for several reasons. First, you acquire many plants of a single species to grow which later you may exchange with other CP enthusiasts. Secondly, the natural variations inherent in the genetic makeup of species are expressed in variation of color, size and shape of the plants. A disadvantage to growing CP from seed is the long interval of time it takes the plant to mature. Also, if growing space is a consideration, the many seedlings do take up space and even more so as they grow larger from year to year. The seed are harvested and stored at 32° - 40° in paper envelopes. Given below are some directions on germination and related data:

Aldrovanda — No experience.

Byblis

gigantea — Requires high temperatures to germinate. Sow seed on wet peat moss and sand surface (1:2). Crush up three paper towels and place on the pot surface and light. After fire dies down, water thoroughly again. Another method uses a soaking in water at a temperature of 170° F. and allowing this to cool to room temperature. FLOWERS: Second year.

liniflora — Germinates readily on peat moss surface after 2-3 weeks. FLOWERS: First year.

Cephalotus — Difficult to germinate. Seeds sown on peat moss usually germinate at variable periods of time up to six months. FLOWERS: Fourth or fifth year.

Darlingtonia — Soak seed in water for a week changing water daily. Then sow seed on peat moss surface. FLOWERS: Fourth or fifth year.

Dionaea — Seed needs constant relatively high temperature to germinate. A temperature of 75-80° F. is about right when seed is sown on the surface of moist peat moss. FLOWERS: Third or fourth year.

Drosera — For the North American *Drosera*, seed germinates readily on peat moss. Plants flower in second year. For African *Drosera*, seed of *D. capensis* germinates quickly but the other species remain for various lengths of time before they germinate. Up to six months. For Australian *Drosera*, the eastern species like *D. binata* and *spathulata* germinate readily on peat moss. I have limited experience with seed from the tuberous *Drosera* but most germinate readily if fresh on peat moss. FLOWERS: two to three years.

Drosophyllum — Snip the tip off the pear-shaped seeds with a nail clipper so that a small portion of the white endosperm shows. Soak seeds overnight in water. Sow seeds on peat moss and sand mix (1:2). When seed germinates, repot singly in a two-inch pot in sphagnum moss and perlite mix. Ratio of mix is 1:1. Treat seedlings with Benlate, a systemic fungicide to prevent damping off.

Genlisea — No experience.

Heliamphora

heterodoxa — Fresh seed germinates readily on the surface of sphagnum moss. FLOWERS: four to five years.

Nepenthes — When seed is very fresh, it germinates on the surface of sphagnum moss at 80° F. FLOWERS: Four to five years.

Pinguicula — Seed germinates for most species very readily on the surface of peat moss at room temperature. For some species, damping off may be a problem, so it is wise to spray with Benlate. FLOWERS: Two to three years.

Sarracenia — Store the seed after harvest in the refrigerator on a damp towel sprayed with Benlate. After six weeks, sow seed on the surface of peat moss. The seeds should germinate in several weeks. Some of the seeds from the northern regions of America need a freeze-thaw cycle while moist to crack the seed coat and allow water to enter and germination to take place.

Utricularia and Polypompholyx — The fresh seed of the terrestrial type germinate readily on peat moss and sand mix (1:1). The aquatic type germinate in water at room temperature. FLOWERS: One to two years.

FURTHER OBSERVATIONS ON DIONAEA MUSCIPULA

by Steve Clemesha

In the June, 1974 issue of CPN (CPN 3:22-23, 1974), I put in a note on some variations that occur within Dionaea. Further observations since then have confirmed most of the points established then and added some new ones. Dionaea, though a monotypic genus with relatively small distribution, varies greatly in several points. Some individual plants have been selected out and given cultivar names in Japan. Since I acquired these I have received additional material which in some cases is intermediate between the original forms.

All the points in which Dionaea varies have been observed before but often assumed to be only a temporary condition or the result of environment. Certainly there is environmental influence, so the observations below are on plants that have been in cultivation in a fully sunlit location. All plants are side-by-side under more or less identical conditions. The points in which Dionaea varies are as follows:

1. Petiole length. At the end of the growing season and also near the beginning of the new one, plants produce a winter rosette of traps on short, broad prostrate petioles. At this stage, plants of all forms are fairly similar. It is in the growing season that the variants show up. One extreme form produces summer traps on petioles which are short and prostrate and show no difference from the winter condition. Most, however, differ to a varying degree. Summer petioles in most forms are longer and more slender than the winter ones. The most extreme forms are more than twice the length of the winter ones. Other forms are shorter but still taller and more erect than the winter ones. In these, winter traps start to form earlier than in the taller forms. Petiole shape varies from parallel to tapered and some forms produce more graceful petioles than others.

2. Color. This factor is more difficult to study than petiole length as some plants that produce dark-colored traps when half grown produce lighter ones when mature, and trap color varies considerably throughout the season as well. Usually, forms that produce dark-colored traps are similarly colored at the center of the rosette and here the color seems more stable. Because of variation through the season, I have been able to select only some very subtle variants with one exception: that is a very pale form which at times of the year looks like an albino, but more often at least some traps have light coloring inside. In this plant the rosette center lacks color.

3. Size. In several U.S. catalogs I have seen Dionaea "bulbs" graded according to size. These seem to be "seedlings"three to five years old, medium bulbs which are five to ten years old, and large or giant bulbs ten years of age or older. I find these size classifications amusing as under my backyard conditions plants will reach maturity from seed in four or five years and an odd plant will do so in a little more than three. Once a plant approaches "medium" size, it will reach full maturity in a season. While it is possible that under poor conditions, under lights, or other artificial situations plants may grow more slowly, they should rarely, if ever, be as slow as the commercial dealers classification implies.

There do seem to be clones of Dionaea that produce traps consistently smaller than others. My completely prostrate form makes traps which are only two-thirds the size of the others. As these are crowded and on short prostrate petioles, they give the impression of being smaller still. At first I believed that these plants were immature but all have remained the same and have not enlarged for three years and are obviously healthy. All my other plants produce larger traps. Their sizes are too similar to select variations except in one case. This is a tall form which has traps also smaller than the others. The degree, however, is not so much so that it is not impossible the trap size will increase next season.

A study of more populations of Dionaea may reveal further variation in this most interesting plant.

PACKAGING CARNIVOROUS PLANT SEED

by James C. Fife

At one time or another, you will find it necessary to package seed you collected from your carnivorous plants. If you do like most people and place the seed in a coin or bank envelope, you may be defeating your objective by increasing seed loss. When CP seed are put in envelopes such as this, whether sealed with mucilage (licking to moisten) or tape, during handling some seed usually manage to get stuck on the mucilage or tape. The "stuck" seed must then be picked off one at a time; for Sarracenia this isn't too difficult, but for Drosera and Nepenthes, plucking them off tape is next to impossible. I once lost an entire year's harvest of Drosera capillaris seed this way! Needless to say, I was very angry.

I suggest you take a piece of wax paper about three or four inches square and fold it in half. It is then folded again, perpendicular to the first fold, on both sides to produce a small wax paper envelope. Be sure to crease the folds well. At no time should tape be

used to keep the folds closed. You may now deposit your seed in the small pocket formed. Now fold the top flap down at least half an inch, creasing it firmly. The creasing tends to keep the envelope from opening up. Tape is not used, for in the event a few seed to work their way out, you wouldn't want them stuck on a piece of tape.

This small envelope is then placed in another envelope made the same way using identical materials, but this one should be slightly larger. On this outer envelope you may now use tape to secure the folds. I also use a small piece of adhesive (surgical) tape as a label, indicating the species and date seed were collected. The wax paper makes an envelope which is transparent, making a quick check of seed very simple. Also, the materials necessary to make these envelopes are very inexpensive and readily available. They can be made ahead of time for those who expect a large harvest or they may be made on the spot as needed. I have found them to work very well, and refrigeration doesn't hurt them at all.

NOTES ON PROPAGATION
by Sam Potter

I thought I would share some of my own propagating hints in short note form:

1. Many, not all, Droseras and Pinguiculas may be easily propagated on water. The method is very simple and effective. I float the leaves on bottled water (distilled or spring water) in clear plastic cups covered with "Stretch-n-Seal" and keep these within 6"-10" of double-tube 4' grow-lux wide spectrum set up on an 18-hour light cycle. Once the plantlets are formed, they may be separated and potted up or placed in terrariums.

2. I find that a mixture of 1 part German peat to 4 parts silica sand ("play sand") to be just as good as live sphagnum for growing most Drosera in closed containers.

3. "Tender Leaf" house plant spray by Dexol of Torrance, California can be used safely and effectively on Drosera, Pinguicula, Sarracenia, Cephalotus, Dionaea, and Utricularia (aquatics not tested).

4. By drawing on propagation knowledge in other plant families, I have discovered a method to get up to 25 plantlets out of a single Pinguicula leaf. A healthy leaf is gently removed and is sliced longitudinally with a razor blade for about 1/2 to 3/4 of its length starting at the proximal end (the end of attachment to the plant). I then place the leaf flat on live sphagnum, slightly covering the proximal end. "Rootone" can be used to advantage on the ventral (under) side and proximal end of the leaf, but is not necessary. Many plantlets will develop along the cut edges.

5. Leaves from resting Pinguicula buds may be used for propagation in the usual manner. This obviously takes up less space than the fully expanded vegetative leaves.

6. Pinguiculas do not like to have their root systems disturbed--Droseras and other CP are not so fussy. I find that if they have a good root system, Pinguiculas, in general, can be grown wet. In trying to establish a good root system, keep them only damp.

7. When trying to germinate Drosophyllum seeds, we often find very poor germination. Do not discard those ungerminated seeds. I am still getting germination on seeds that were planted one year ago and left untouched in a covered container.

8. Better germination of Drosophyllum seeds may be obtained by soaking the seeds overnight in a dishwashing solution of "Calgonite"--a surfactant. Many other surfactants would presumably work as well.

9. I find excellent response to foliar feeding of 1/6 strength "Spoonit" fertilizer.

10. The best mix I have come up with for epiphytic or semi-epiphytic Utricularias is: 4 parts silica sand ("play sand") and 1 part German peat moss. Water with 1/6 strength "Spoonit" fertilizer. Please note: there is a big difference in growth rate when using dilute fertilizer. This mixture is also the best I have found for seed germination of any CP.

DROSERA BURMANNI IN QUEENSLAND, AUSTRALIA
by George Ashley

This is a most unpredictable plant. My first encounter with it was the sixth month of 1966 when a friend in Melbourne asked me to look for it. I found it quite close to home, but after a few weeks it disappeared and I have not found it in that spot since. A quarter of a mile away I found another patch and again in August I found large patches after a lot of rain. These were small seedlings and grew under water; however, dry weather quickly dried them up and only one or two plants were left and flowered when only one-half inch in diameter.

This year I found another batch quite close to the others but unfortunately they are now under a large industrial building. The latest find are growing on a slight southern slope and there is a slight soakage coming through keeping the ground moist. Those do not grow very big, only about 1 1/4 inches across, and are a pale yellowish-green growing amongst short grass and often covered. The only way I have ever found them is by noticing the flower scape sticking up through the grass. Other times I have seen them growing up on ground out in full sun and

often you will find young ones growing on a sand that has been washed down from above. The seed germinate quickly on this sand. Seed do not seem to have a set season for germinating as I found seedlings at all times of the year, summer and winter, but only after much rain. It would seem they require much moisture to aid germination.

I also found them at their best at Mooroochydore, about 65 miles north up the coast from Brisbane. Here, I have found them growing on the side of the road very prolifically where they are often mowed over. They reach two inches in diameter and are yellowish-green often with the tips of the leaves a bright orange or red. When you get one of our real dry spells which occur from time to time, they will then flower profusely and set seed followed by the plants shrivelling up and disappearing only to reappear with the first good rain. They also can grow within a few feet of high tide near the beach.

I also found the species growing at Stanthorpe which is 140 miles south of Brisbane at 2000 feet altitude. This is one area in Queensland that really gets cold, even down to zero degrees Centigrade. It often snows here in winter and the plant grows in places where there is constant seepage.

A few general ecological points about Drosera burmanni: it grows at temperatures from below freezing to over 100°F. and at altitudes from sea level to 2000 feet. Soil is peaty sand at the coast, black loam near home with a small amount of sand and decomposed granite at Stanthorpe. It needs constant moisture, not stagnant water as found in a swamp condition but water must be in motion. I also found it growing on rather dry ground; during wet weather it drains readily.

THE SEARCH FOR THE 27 POINT DROSERA BINATA

by George Ashley

My wife and I started off on our trip early to get the 8:30 bus to Stradbroke Island. The journey to Stradbroke takes two hours--about one hour ten minutes by bus and fifty minutes on the barge which carries the bus. The bus stops off by some shops and a cafe where we got off and bought a few things for lunch. We continued on foot for another half mile, and under a shady tree and nice soft grass, we unpacked and had a snack and a cup of tea. I then changed into waders and made for the swamp across the road.

The swamp is quite large--only the road and about twenty yards of grassy ground separate it from the beach. This is the swamp where I collected sphagnum moss along the margin. For about twenty to fifty yards grow many swamp trees. However, I decided to go into the swamp itself and finally reached the middle where it was mainly deep holes about waist deep and small hummocks of ground and thick with reeds and sedges. It was amongst these I found a few Drosera binata, not 16 points, but 18, 20, and 21 and, believe it or not, I saw what I took to be two leaves but it turned out to be one with 27 points. Around the base of these plants were growing thousands of seedling Utricularia species. I collected specimens of all plants and then returned to my wife and we had lunch and a rest.

Next, we walked up to the swamp I visited a while ago at Eastertime which was about 1/4 mile farther up the road. This swamp is between the road and the beach. D. binata grows almost to the edge where the salt water comes at high tide. Since the area had a fire through it a few months previous, all the long grass and reeds were burnt out, but the Drosera have regrown and are more robust. They are much shorter, compact plants now and have many thick short leaves, but I never found one with more than 18 points. To reach these, you climb down a ten-foot bank right off the roadside. This area would be about 120 yards from the beach to the road. Looking down from the road, the Drosera with their dewy leaves give the appearance of mist that is quite attractive. The leaves are deep red in color and are all much branched, quite different from the southern form. I might add that when collected amongst the long grass, the leaves tend to grow very long and very floppy being supported by the grass and reeds reaching nearly three feet and often have a green color due to being shaded from the sun. The dewy appearance first thing in the morning sunlight is a very attractive sight indeed before they dry up during the day.

Unfortunately, due to mining for mineral sands, this island is fast becoming spoiled and one large swamp right near where the barge lands has already been filled in and covered over with the waste sand after the minerals have been extracted.

I found several Utricularias about six inches tall with bright blue flowers as well as some D. spathulata. These are the only two Drosera that I have ever seen on the island.

ENDANGERED CP
by David Lane

Since the stated policy of CPN and an expressed interest of subscribers (CPN IV:2) is conservatory, I am writing to pass on the following excerpts from the "Report on Endangered and Threatened Plant Species of the United States" by the Smithsonian Institution (House Document No. 94-51). These excerpts are of special interest since the specific status of certain CP species is listed. Also included are brief general or explanatory quotations.

Dealers and collectors should be aware that publication of the lists in the Federal Register may proscribe collection, transport, and sale or ban commercial trade under the Endangered Species Act of 1973. This warning is not intended to promote "last-minute...predation" (p.29). Inclusion in the Convention on International Trade in Endangered Species of Wild Fauna and Flora may follow. For further discussion and state lists see the report. The species listed, as well as CP of other countries, may also be covered in a Red Data Book (Volume 5 on angiosperms) being prepared by the Survival Service Commission of the International Union for Conservation of Nature and Natural Resources (IUCN) based in Morges, Switzerland. "There is a very large trade in the sale of exotic-looking carnivorous plants, such as the Venus Fly Trap, and pitcher plants, including Darlingtonia." (p.31)

Endangered Species: "In danger of extinction...rare, with limited geographical distribution, and often occur in fragile, threatened habitats." (P.48) Pinguicula ionantha (p.60) and Sarracenia oreophila* (p.66)

Threatened species: "Presently are not endangered but are likely to become so within the foreseeable future...rare, with a restricted range, or they occur in specialized habitats." (p.68) Dionaea muscipula* (p.81), Pinguicula planifolia (p.86), Darlingtonia californica* (p.95), Sarracenia psittacina* (p.95), and Sarracenia rubra* (p.95)

* Separately listed as commercially exploited (pp. 36,37)

"Cultivation or artificial propagation, even in the best botanical gardens, is not an acceptable alternative to in situ perpetuation of species. Preservation of a species' future cannot be assured this way. Artificial propagation is a last resort and is done always with the ultimate objective of re-establishing the species in its natural habitat." (p.25)

It is hoped that publication of this information as a short note would promote international "coordination"(pp. 199-200).

GROWING CP UNDER ARTIFICIAL LIGHT
by Grady Lucas

In reply to your request for information on growing CP under artificial light, I send to you what I have been doing, and it has been working quite well for me.

I use a bank of seven fluorescent lamps (4 ft., 40 watt), 1 warm white, 1 Grow lux, 3 cool white, 2 deluxe cool white, with an 18-hour photoperiod. My Dionaea are twenty inches from the lamps, and they are very well formed and the traps are red, and they are in bloom. My Drosera (Drosera capensis, Drosera binata, Drosera filiformis, Drosera tracyi, Drosera intermedia, Drosera capillaris, Drosera rotundifolia) are from twelve to fifteen inches from the lamps, the tentacles are very red, and they are all in bloom. The Drosera binata has seven flower stalks and two or three of them bloom simultaneously. My Sarracenia (Sarracenia minor, Sarracenia leucophylla, Sarracenia purpurea ssp. venosa, Sarracenia psittacina, Sarracenia alata, Sarracenia rubra, Sarracenia flava) are all well formed and the pitchers are very well veined red. They produce copious nectar and the traps are filled with insects. The Sarracenia are from two to twenty inches from the lamps.

One month I gave the plants a 24-hour photoperiod. Never seeing darkness, they seemed to grow a little faster, but the flowers would open and close irregularly. It did not seem to hurt the plants any, though I have read that you can grow some plants to death in this way. I also exposed the plants to black light for several weeks. I did not notice any change in their growth rate or color.

During spring and summer, give the plants the conditions stated above. In winter, merely reduce the candlepower and the temperature to between 35° and 45° F. and the plants will go dormant. In three or four months, raise the candlepower and the temperature to normal and the plants will start new growth. Using this method I have never lost a CP.

Everyone I have talked to seems to think that you have to place plants right up against the lamps (two or three inches). I tried this and had very poor results, namely the drops of mucilage on Drosera were evaporated, I suppose from the heat of the lamps and the low humidity. This no longer happens with them 12-25 inches from the lamps. I have my CP in a

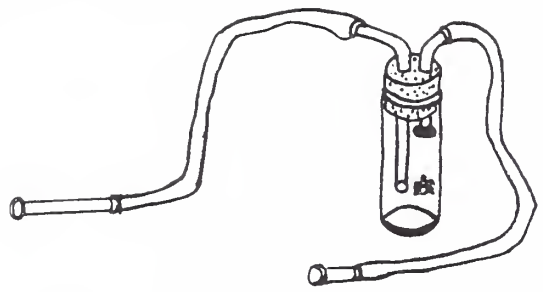
small greenhouse I built, 5' x 3' x 27", sealed with a very thin clear plastic. The plants are misted four times daily.

I would like to hear from anyone growing Cephalotus follicularis, Drosophyllum, Byblis, and Nepenthes. My mailing address is: Grady Lucas, 2119 Romine Road, Little Rock, AR 72205. I will buy and possibly trade for the above plants. Also, thank you for a wonderful CPN. It is much more than I expected, and I hope that it remains as it is.

SPOON FEED YOUR INSECTIVORES?
by Jim Chester

If your insectivorous plants are housebound, as are mine, there is little or no opportunity for them to capture insects. This not only deprives the plant of needed nutrients, but also deprives their owner of the "excitement of the capture." One is thus forced to "import" bugs. A little device used by entomologists called an aspirator makes the capture and transport of even the tiniest insect a snap. The accompanying illustration should adequately explain construction of this tool. To use it, place the capture tube next to the insect and the suction tube into your mouth, then simply suck the insect into the collecting vial. For obvious reasons, there should be a screen (or piece of gauze, etc.) over the far end of the mouth tube. While in the field, the vial can also double as your storage container for captured insects.

For those who are too impatient to wait for the plant to capture its own food, you can also "spoon feed" your plants with this device. Simply switch tubes and suck the insect into the tube with the screen. The screen will stop the insect from being sucked into the vial. Next, direct the tube with the "tender morsel" in it towards a particular trap, Drosera leaf, or even into a Darlingtonia hood, then blow on the screenless tube. Presto, the insect is blown right out where you want him. Certainly beats trying to catch and feed an insect to a plant with a pair of tweezers. A warning though--"spoon feeding" your plants can turn them into incorrigible beggars.



Materials:

3½ inch high plastic or glass vial

rubber 2 hole stopper or a secure plastic lid through which holes can be punched

2 14 inch pieces of ¼ inch plastic or rubber tubing. Glass or plastic fittings shown are optional

Fine mesh screen- piece of nylon stocking works well

SPECIAL NOTICES

We have been informed that MARCEL LECOUFLE, a commercial source of Nepenthes in France, is out of Nepenthes and does not know when he will get more.

We have word now that Plants of Prey has been reprinted by the University of Western Australia Press, Nedlands, W.A. and is available now from a book service in the U.S. The specifics are as follows: Plants of Prey by Rica Erickson, a book that consists of descriptive text covering carnivorous plants found throughout Australia. It is profusely illustrated with eighteen full page plates, ten of which are in full color. 84 pages and published originally in 1968. All orders from abroad and from individuals must be prepaid. Bank drafts in U.S. funds are necessary for foreign orders. ISBS pays postage on all prepaid orders. Price is $9.65 and may now be ordered in the U.S. from:

International Scholarly Book Services, Inc.
Post Office Box 4347
Portland, Oregon 97208

CPN KWIC ABSTRACTING SYSTEM

What on earth is that? Well, we think it is the biggest side project of CPN since the seed and plant exchange began and the worldwide list was completed. LYNN MACEY has made a large beginning in storing information in retrievable form in a computer so that through the use of several descriptor angles, a subscriber can request a data output on any genus or species in the computer and will receive a biblio of all the literature from all sources stored to date in addition to an abstract if he so desires. He has already entered all of the literature reviews appearing in CPN since it began, in addition to anything else he could get his hands on, CPN articles and notes too, and references used in notes in the newsletter. Lynn will need help in getting more material to store, so if you have older articles, books, etc. or any other material which has not appeared in CPN (Lynn already has all of that), you can send an abstract. Soon, he will be ready to make printouts at a very nominal cost including computer charges, paper, postage, etc., only. In the meantime, to get a very nice summary, samples of what can be done, and instructions on sending in your abstracts or extra reprints, send an addressed envelope with TWO (2) first class stamps to Lynn Macey, 511 North Eby, McPherson, KS 67460. WE URGE ALL SERIOUS CP STUDENTS TO COOPERATE FULLY IN THIS IMPORTANT PROJECT. Send that stamped envelope for your info packet today.

Some CPN subscribers have sent in funds for several years' worth of future CPN subscriptions based on the current subscription price. With the new rise in subscription rates this has changed the situation for many. All of these multiple-year subscribers will be notified by mail on the status of their accounts with us. If you do not hear from us, it will mean that you have no funds left to cover next volume's subscription price. Notices will be sent before the end of August. Those who have funds which only partially cover the subscription price will also be notified.

All those who ordered either the Japanese books or the R. Schwartz book should have them by now. We would like to thank everyone for exercising great patience during the long period between the order and actually receiving the book. We were sent some extra copies of the Schwartz book which we would like to sell as quickly as possible. Domestic price is $5.50 postpaid. For all others it is $5.75 postpaid. If you order, you won't have to wait long since it would be mailed immediately. Send your check to: J. A. Mazrimas, 329 Helen Way, Livermore, CA 94550.

Allan Swenson of Armstrong Associates, Inc. is preparing a book on carnivorous plants. He would like any information about growing the plants in terrariums, the classroom, office, or home. Photos are also appreciated. Any experiences about any phase of the growth cycle which would be interesting to those who will read the book are also wanted. Write to: Allan A. Swenson, Windrows Farm, P.O.Box 94, Kennebunk, Maine 04043.

We are in need of a volunteer who could handle back issues of CPN by inexpensively Xeroxing all back issues in large volume and selling them to CPNers upon request. We receive many requests for back issues but not enough to have old copies reprinted without paying exorbitant costs. We feel that old copies can be Xeroxed much more cheaply than printed, and sold to members for a reasonable cost. Anyone interested in this project, please contact us for details.

We receive many requests from subscribers for Nepenthes plants or cuttings. This flow of requests stems from the fact that the commercial sources are very limited in number and their supply of these rare plants quickly outstrips the demand. Over the last five years we have been diligently working towards propagating these plants in order that more people can enjoy growing them. As a result, every spring, about March-April, cuttings are made from the plants which are available to CPN members. Since supply of these cuttings are still very limited, we would like to distribute these cuttings under the following conditions: In your request for Nepenthes cuttings, please send J. A. Mazrimas information on the size of your facilities, how you intend to root the cuttings, temperature range, light, etc. Choice of species or hybrids is his and a total list appears in the seed exchange plant list obtainable from Bob Ziemer for 50¢ a copy. Past issues of CPN give proper methods for rooting and growing the plants. The cost for the cuttings is twice the postage on the package and usually will be in the range of two to three dollars for domestic mailing. In order to have fair distribution, we will send cuttings first to subscribers who have not received cuttings from us in the past. We would prefer that these plants be exchanged freely as are other CP genera and not sold for an exorbitant price. Although the number of cuttings will be limited, your name and needs will go into our file if we are temporarily out. Please enclose a stamped, self-addressed envelope for a reply.

RECENT LITERATURE

Affolter, J.M. and Olivo, R.F.: Action Potentials in Venus' Flytraps: longterm observations following capture of prey. Am. Midl. Nat. 93:443-445. 1975.
Electrodes were connected to traps and failed to detect action potentials after trapping unless the prey was still alive and moving.

Kondo, K., Kondo, T, and Bogner, J.: Nepenthes: ornamental Asiatic pitcher plants. American Horticulturist 54: 17-17. 1975.
A very nice article covering basic biology and culture and with good color photos of N. burbidgei, N. madagascariensis, N. bicalata, N. stenophylla and two unlabeled black and white photos of species growing in Longwood Gardens.

Ottewell, Guy: Venus Flytrap. American Horticulturist 54: 12-13. 1975.
A lightweight article with little information, a great deal of misinformation, and generally not very worthwhile looking up.

Rowland, J. T.: Carnivorous seedplants: sources and references. Hortscience 10:112-114, 1975.
A very good reading list covering a cross section of CP literature, with a list of commercial sources.

Schnell, D.E.: Growing native North Carolina carnivorous plants. NCWFPS Newsletter, Spring, 1975. pp. 9-12.
Article concentrates on outdoor growing in the Carolinas.

Shaw, S.: Death of a lake, birth of a forest. Nat. Wildlife 3:42-47, 1975.
A very cursory treatment of bog eutrophication for popular consumption, but two fine color photos of Drosera rotundifolia and Sarracenia purpurea ssp. purpurea included among other non-CP species.

Stronach, Ann: (Cover drawing of S. rubra jonesii), NCWFPS Newsletter, Spring, 1975.
A fine line drawing based on a photo by Don Schnell.

Taylor, P.: 183 Lentibulariaceae. Opera Botanica Ser. B, No. 4, pp. 9-25. 1975.
This monograph covers the family in Ecuador, including one Pinguicula and nine Utricularias.

Tim, S K-M.: Insectivorous plants and terrariums. Brooklyn Botanic Garden Record 30(4): 31-35, 1975.
Illustrated article describing some American CP and their culture in terrariums.

Waters, J. F.: Carnivorous Plants. Franklin Watts, Inc., New York. 60 p. 1974
A beginning children's book with some black and white photos and line drawings, many of the latter fanciful.

Wherry, E.T.: The hectic history of the upland pitcher plant. NCWFPS Newsletter, Spring, 1975, pp. 7-8.
The author discusses the history of S. rubra jonesii.

RENEW FOR 1976 TODAY!

USE THE CONVENIENT FORM ATTACHED TO THIS ISSUE

CARNIVOROUS PLANT NEWSLETTER

Volume IV, No. 4

DECEMBER, 1975

CO-EDITORS: D. E. SCHNELL, Rt. 4, Box 275B, Statesville, NC 28677, USA
J. A. MAZRIMAS, 329 Helen Way, Livermore, CA 94550, USA

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Published quarterly with one volume yearly.

SARRACENIA MINOR ---

This is an old print that was found loose in a used bookstore and sent to us by Mrs. Nancy Stronach. Note the incorrect epithet "adunca", indicating the relative age of the print although not helping with the exact dating. It may possibly be from Smith's original 1804 publication, although unlikely considering the fine condition of the print which is in color.

RENEWAL REMINDER

THIS IS THE FINAL NOTICE OF RENEWAL! Subscribers should return the renewal form in the previous issue along with their check in order to insure uninterrupted subscription to CPN throughout 1976.

CHANGE OF ADDRESS

STEVEN M. GRAEBNER (Box 5483, Duke Station, Durham, North Carolina 27706).

NEWS AND VIEWS

OWEN H. TALLMAN of Sun Dew Environments (P.O. Box 503, Boston, Mass. 02215) sent us a long letter on his own accord, volunteering a bit of history and the ethic of his CP business. Owen and his partners first worked for a large metropolitan zoo and left because they "were disgusted with the abuse of animals and people which was done in the name of education and community development." While trying to establish a wholesale source for the plant business they then started, they were soon disillusioned again when they discovered (sometimes from wholesalers' own admissions) the extent of wild collections in order to fill orders. "After learning that, we decided that rather than get into another unethical line of business, we would sell off the collected stock we had already purchased and begin anew with entirely propagated stock in the beginning of 1976." The propagated plants are doing well and their stock is rapidly enlarging. Their aim is "to provide a greater variety of plant material at a decent price and the cultural information needed to grow and propagate it successfully." They are also working on a cultural manual which they hope will be very complete and will sell from $1.00 to $4.00. In the meantime, a stamped self-addressed envelope will bring you their present list.

LEX REIBENSTEIN (P. O. Box 131, Valley Cottage, NY 10989) has designed and silk-screened by hand a "grow your own" tee shirt featuring Dionaea in green ink on white cotton. The shirts can be tie-dyed in blue or red on request. They are currently available in men's medium size (38-40) and are $4.50 postpaid. This must be the first team jersey!

COLIN WHITING writes again to tell us he bought Charles Darwin's book Insectivorous Plants, second edition. This is the best edition since it was brought up-to-date by his son Francis by a series of footnotes. Strangely enough, he does not mention pitcher plants at all except for a short note on the last page, although he has chapters on Dionaea and Aldrovanda. The book is rare; anyone having difficulty should try:

Kew Books, 69 Kew Green, Surrey, England TW9 3AH

Wheldon and Wesley, Lytton Lodge, Codicote, NR Hitchin Herts, England

The following information might be interesting regarding various editions:

First edition 1875 Murray Second thousand 1875 Murray
Fourth thousand 1876 Murray

Authorized American edition, Appleton, New York 1899

Second edition revised by Francis Darwin, 1908 Murray, six thousand

I do not think any more were printed after this.

Another item from COLIN WHITING is that there was a television program shown here in August that featured a few minutes on carnivorous fungi. The shots showed it capturing its prey of nematodes. It is called "The World Beneath Us" and lasted for fifty minutes showing all aspects of animal life underground including the mole.

COLIN writes that he was introduced to CPN through DAVID TAYLOR'S advertisement in an English magazine. However, owing to his recent marriage and setting up home, he had little time to get acquainted with CP. But he became interested in the flora of the British Isles and tried to see as many flowers as possible in the field. On these trips he has seen many insectivorous plants in the British Isles. Recently in June, 1975, he took a trip to Ireland and would like to share his observations with us:

"How did we come to be walking in the rain to some unknown destination at least eight miles away in remote Ireland? My wife's thoughts were no doubt centered on whether we would find any accommodation in this sparsely populated area. Mine were on more important thoughts; would we find one of the locations in Ireland where Sarracenia purpurea grows? The guide book we were using (dated 1934) stated that the area was in one of the more remote and wild areas of Roscommon. The bog lies two miles WSW of Termonbarry Co. It was crisscrossed with rivers and not being sure how treacherous peat bogs are, we stood there in the rain and were not offered any lifts. We were walking because our car with camping equipment broke down, and we managed to get to Dublin and took a train to this spot. Our small rucksack was full of plastic bags, Wellington boots and a spade, so we had no change of clothes or washing gear and already we felt like tramps.

"Eventually, we came upon a home where we were able to stay. By luck, the owners knew of the pitcher plant site and kindly took us there by car. As it happened, the site was only a few yards from the road. The site appeared to be roughly 100 yards square in area and was covered with plants growing at all stages. The site is a peat bog drained on one side by a ditch and on the other by peat cutting which I understand the locals have stopped to save the plants. On the other two sides, the bog extends some distance allowing for expansion by the plants.

"The initial introduction was made by Benjamin St. George Lefroy in 1904 when he brought plants of three species of Sarracenia from Canada, S. leucophylla, S. flava and S. purpurea but only the latter survived. The plants were growing in these sphagnum bogs along with Drosera rotundifolia. The name of this bog is called Termonbarry bog and due to the extensive large-scale turf cutting operations, it may not be possible to preserve this site much longer. So, many other introductions have been started in other sites over the years with some success.

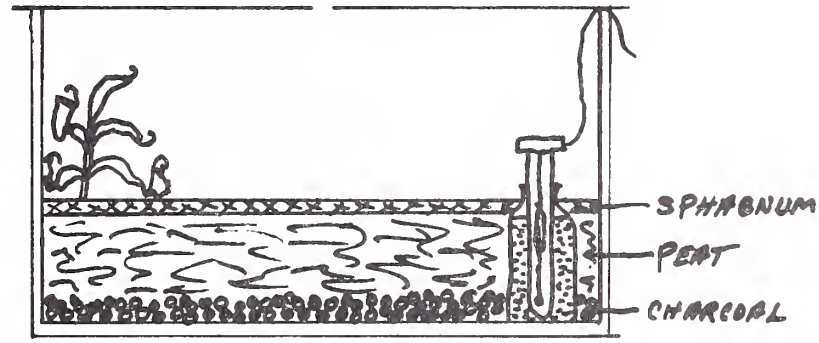
"Earlier in the holiday, we had seen Pinguicula vulgaris and Drosera rotundifolia. The Drosera seemed to prefer the dryer parts of the bog and in other locations was seen in a heath type environment in the absence of sphagnum but with ants present. We also saw Pinguicula grandiflora which grows in profusion around the ring of Kerry. This plant favored shade as much as sun, the dominant factor seeming to be the degree of dampness. Incidentally, the plants were seen growing at sea level."

On collecting scientific data from various CP locations in Oregon and N. California, BOB HANRAHAN sent the following information taken in August, 1974:

	BULL SWAMP, OREGON	CALAMIOPSIS, OREGON	PANTHER FLAT, CAL.	TRINITY CENTER, CAL.
pH of water	6.4	7.4	7.4	7.3
Dissolved solids	20 PPM	150 PPM	35 PPM	35 PPM
pH of soil	5.4	7.4	5.4	5.1
Air temperature	68° F., 1700 hrs.	74° F., 1600 hrs.	59° F., 800 hrs.	-----
Humidity	56%	61%	83%	65%, 1400 hrs.
Light level	10,000 F.C.	10,000 F.C.	300 F.C.	10,000 F.C.
Plants	D. anglica U. vulgaris U. intermedia	P. vulgaris Darlingtonia	Darlingtonia D. rotundifolia	Darlingtonia

DAVE KUTT writes: "This has been a good growing season here. The Nepenthes and Cephalotus through foliar feeding and root feedings have doubled in size. The start of Cephalotus I received in 1973 is becoming a mature plant with one-inch pitchers that will become larger given more time. German peat with Utricularia (terrestrial type) growing in it is an excellent growing medium. Using a shallow tray as opposed to a pot will cause Cephalotus to spread across the surface and create more pitchers. I use German peat also for reproducing a tuberous Drosera stolonifera. I lay the stems that have no tubers one-half inch below the surface in a horizontal manner. Often, more than one break will result and usually one tuber at least forms."

CARL TAYLOR writes to tell us about his method of growing Nepenthes: "As you can see in the drawing, my terrarium is made of glass with cast iron siding to it. It is covered with two separate pieces of glass that can be manipulated to control the ventilation. In the first step, I cover the bottom with a couple of inches of charcoal and then I add peat moss to about the 4-6 inch level. I cover the top of the peat moss with live sphagnum. I then clear out a spot in the right front corner of the terrarium just big enough to insert a quart jar in the hole. My 50-watt water heater with thermostat is added. This water heater can be purchased in most pet stores. I add water to the jar and set the temperature for the proper amount of heat depending on the size of the terrarium. My terrarium is 2' x 2' x 18". After installing the water heater, the Nepenthes can be planted and the temperature should be checked from time to time. The air stays saturated with moisture evaporating from the jar creating a tropical rain forest in my 'Nepenthes case'. The only



drawback to this method is that you must watch the water level inside the jar to be sure it doesn't run down too low. Usually some water must be replaced every two to three days."

KATSU KONDO is currently working at the University of Hiroshima, Hiroshima, and at the Kondo Collection, Sanmei Kosan, Ltd., Nagoya. He is editing a new book, Hortus Kondoi - Nepenthes, coming out next year in Japan. The text will be written in English by T. Kondo and all the photographic illustrations, in color, will be taken by I. Hayashi, a professional photographer of Japan's largest news press. The book will be a limited edition and the copies will be distributed only to institutions. Institutions which want to receive copies should write to Katsu.

The Kondo Collection maintains its own large natural bog. There are large, dense populations of Dionaea, Drosera, Utricularia, and Sarracenia from the southeastern United States, and some CP's from Australia as well as Japan's native CP's. Darlingtonia is in good shape there, also It seems that all the natural environmental factors there fit CP's from the temperate to alpine zone. Some friends from the U.S. have visited this protected area and have enjoyed seeing their native carnivorous plants. If you want to donate your extra plants originally grown in the temperate zone to this bog, write to Katsu. If you make a trip to Japan, visit this large CP bog.

PETER JOHNSON came across the following while researching medicinal value of CP: "In five successive volumes of LLOYDIA: A Journal of Pharmacognosy, I came across a monumental survey of some 3,000 plants by Jonathan L. Hartwell of the National Cancer Institute, Bethesda, Md., entitled "Plants Used Against Cancer: A Survey," running from 1967 to 1971. In Vol. 32 (1969), No. 1, pp. 106-107, six species of Drosera: indica, intermedia, longifolia, rotundifolia, and two unspecified, were listed as having been used against "corns, calluses, warts, wens," and so forth, in such parts of the world as North Vietnam, the Pacific Coast, the Carolinas, New England, Norway, Finland, and England. His references went back to the Sixteenth Century. The survey had nothing at all on Sarracenias, nor Utricularias, but mentioned some Pinguiculas.

Alice Henkel, 'Wild Medicinal Plants of the United States,' USDA Bur. Plant Industry Bull. 89(1906), lists Drosera rotundifolia, S. purpurea, and S. flava as "nonofficial" remedies. In regard to the Sarracenias, she says merely that the 'roots and sometimes the leaves are used.' For what, she didn't think it was her job to say. In a later bulletin in the same series on root drugs, she does not mention the rhizomes of Sarracenias at all!"

LEO SONG writes that he has started rooting Nepenthes cuttings by treating the cut end with 3000 ppm IBA (Indole Butyl Acetic Acid) in a 50:50 isopropyl/water solution. Then he wraps the cutting base in sphagnum moss and the top in a baggie or larger plastic bag depending on cutting size. Roots appear within a month on most cuttings. He places cuttings in orchid bark in a cutting box with a screen bottom over the heating tubes which gives ample bottom heat, especially at night.

We received another progress report from G. ASHLEY of Queensland, Australia, who revisited Stradbroke Island "to check on Drosera binata and found quite a number in the area that I mentioned previously. This area had been burnt out and to my amazement there were some really good plants. These, of course, were the same plants as before, but what a difference because these were all putting out new leaves and many leaves with over 30 points. I noticed that many of the mature leaves dry up very quickly in the wind and there were many immature leaves to replace them. However, there were no plants as yet in flower. I have taken some photos of one plant with a leaf of 35 points which had one large leaf, one leaf all dried up, and one leaf just shooting up from the base. There were also quite a number of Drosera spathulata with white flowers which were somewhat larger than the pink-flowered form and also an odd plant with a branching flower scape. The seedlings that came up turned out to be Drosera binata. This is the first time I have ever had the seeds grow amongst some Nepenthes seeds and came up after the Nepenthes had germinated. Some have already divided in a young stage. I should think that any plants that come from the area on Stradbroke Island should produce 30, 35 points and, who knows, I may find one day a plant with leaves producing 40 points!"

DAVE KUTT sent the following items: "Dormant Aldrovanda turions were being stored under refrigeration at approximately 38° F. After six weeks at 38° F., the refrigeration equipment malfunctioned and exposed the jar of living sphagnum, water, and turions to below freezing temperatures somewhere around 25° F. The water became a solid block of ice with turions inside. The mass was maintained in this frozen state for five months and after thawing, no harm had been done to the turions whatsoever! This apparently could be a way of storing Aldrovanda for later use. The inert quality of a frozen mass would make loss of material very unlikely.

"Drosera villosa has been successfully reproduced here from leaf cuttings taken just prior to dormancy. The cuttings were placed on a rounded mound of sphagnum face up in the usual fashion. A single layer of cheesecloth was stretched tightly over the mound and secured in place with a rubber band. This holds the entire back surface of the leaves down against the

moist moss at all times. The whole thing was placed in a sealed baggie and placed in a 65° F. shaded area with adventitious buds appearing three to four weeks later.

"A systemic insecticide has been tried successfully on Nepenthes, Cephalotus, and Nepenthes seedlings with no apparent harm to the plants. The product is made by "Science" and is simply called "Systemic Spray." It contains meta-systox, methoxychlor, and kelthane. Currently the product is being tested on D. binata and capensis plants. All experiments have involved normal dilution."

JIM FORREST says that as far as he knows, the main cities in New Zealand have CP collections but these are not on display because the public steals or interferes too much with them. Having good or bad collections depends on the knowledge and enthusiasm of the people responsible.

TERRY BROKENBRO writes in to tell us that the CP book titled Plants That Eat Animals is written by Dr. Linna Bentley and illustrated by Colin Threadgall and sells for L 1-15 in the U.K. "Though I have not personally seen this book, I can tell you it is aimed at children from the ages of eight to thirteen. I think this is worth noting; otherwise, a few subscribers may find it a little too elementary. The book has thirty-two pages with sixteen illustrated pages in color. I may purchase this book at a later date . It is one of the relatively few CP books on the British market. I'll send comments when I buy and read it.

"I have details of another supplier of sphagnum moss for users in England. Their catalogue says 'Best Dartmoor sphagnum moss, always fresh, ideal for propagations, etc. One pound bag at 50 p and Ll.' The address is Burnham Nurseries Ltd., Orchid Avenue, Kingsteigston, Newton Abbot, Devan TQ12 3HG."

BOB HANRAHAN just returned from a tip to the Eastern Seaboard after visiting some CP sites. He noted that where the aquatic Utricularias were growing, the water had a pH between 5.8 and 6.2 and the salinity was generally about 25-35 PPM. Because the water was shallow, the temperature was equal to the air temperature. He noted that the soils where Dionaea and Drosera were growing had a composition of about 50% sand, 40% silt, and 10% clay. The sand was about 60 grit. Bob promised a more detailed writeup in the near future. He noticed several swamp areas were being drained even though they contained many species of CP.

JIM FORREST noted that when he potted up some small seedlings of various Sarracenia hybrids and species in sphagnum moss, the moss grew prolifically hiding the plants. When they were looked at some time afterward, he found that small plantlets were growing from the leaf head in a manner of strawberry runners. He observed this on Sarracenia flava seedlings. Darlingtonia plantlets in the same moss did not form any secondary plantlets but certainly enjoyed the moss.

DR. KIYOMICHI HANABUSA has been a CPN member since Volume I was issued. "Recently I came from Japan to Basel, Switzerland. I have grown more than one hundred species of CP when I was in Japan. Last Sunday I met Dr. Steiger at Bern, and he picked me up to visit the mountain (east of Interlaken near Grimselpass) to see Pinguiculas. It was cold and somewhat rainy, but fortunately we could see three species, P. leptoceras, alpina and vulgaris. Some of the P. leptoceras were still in bloom and showing their tiny violet flowers."

LARRY MCCULLAH sends us a copy of a letter that he found recently in a copy of Lloyd's Carnivorous Plants he purchased in a second-hand bookstore. We would like to share some pertinent excerpts from this letter which was written two years before the book was published. Lloyd wrote the letter to a friend from Carmel, California and at this time was professor emeritus from McGill University. "Dear Liberta Brown: It has always been a puzzle to me how many people looked me up in Who's Who, and why (not and Why). To be sure I have got on many a sucker list, and the bulk of my mail has increased thereby. And some of the longheads have measured the greatness which accrued to America by immigration by counting, among others, the Welshmen. But on the whole nothing much has happened till now...

"And now my wife and I are again on the Pacific coast, but where there isn't so much rain as in Oregon--a good place for old folks--where we are living comfortably enough in an old bit of a house we built in 1911 when we used to come here in summer to work in the Carnegie Institution Laboratory here. This has now been given up--liquidated to use Russian terminology--so I now have a small laboratory of my own to work in. Just now I am finishing a book on Carnivorous Plants, to be published during the coming year I expect. It will be my last major effort--there are too many books anyway, but this one is different and important, of course. I have here the association of some biological colleagues at the Marine Station nearby, belong to Stanford University and the young chaps keep me from getting rusty and stagnating altogether. Our home is in the woods of our acre, which we shall keep unimproved (save the word) as long as we are here...

"We have two boys, men now. The older, Francis, is here married to a fine girl and we have two grandchildren, and we have just concluded a joyous Christmas (for the kids)...The younger son became a Rhodes scholar and got his Ph.D. at Oxford in physiology with a first and is now at the Rockefeller Institute in New York. He is married and we have us a granddaughter, looks like her father or mother or someone...Faithfully yours, F. E. Lloyd."

(He wrote this letter at the young age of 72.)

JOE MAZRIMAS writes: "Several people inquired about conditions and preparations needed for dormancy of various CP. In California, I set my plants of Sarracenia, Dionaea, and N. American Drosera outside under a lath house about October first. During this time, they slowly acclimate to the cooling weather climate from the warm temperatures in the greenhouse. I don't cover the plants at all but I make sure they have sufficient water to remain moist but not saturated. I find that covering the plants in plastic bags or several layers of canvas encourages the production of fungal and mold infections. Similarly, storing plants in the refrigerator in plastic bags to induce dormancy conditions is also dangerous practice because the plants are prone to rot. So, the best policy is to allow the plants to have access to fresh air. During this time, Sarracenia pitchers start turning brown from the top down. Dionaea traps turn black, and Drosera leaves stop growing and the tight winter bud forms. It takes approximately three to four weeks for the plants to reach a true dormancy state, after which they are resistant to cold temperatures. I find that plants can withstand 20° F. (-7° C.) quite well for long periods of time. They probably can tolerate lower temperatures without covering to 10° F. (-12° C.). When temperatures lower than this are predicted, I would cover the plants lightly with a canvas cloth or tarp allowing free flow of air at the sides. Usually, the containers were frozen solid for weeks at a time without any serious adverse effects on the plants. Severe cold periods will sometimes cause some damage of the first leaves that emerge from Dionaea or Sarracenia, but subsequent leaves are normal in appearance. In conclusion, when the leaves have mostly turned brown or black, I trim them off about one to two inches above the rhizome. I hold back on the water and just maintain sufficient moisture in the medium to prevent wilting. Under these conditions, many of my plants survive the rigors of winter quite well, and I anxiously wait to see the first leaves poking through the moss announcing the awakening of the spring season.

R. W. RAMSDEN writes: "I am a CPN subscriber and CP enthusiast myself, as well as an owner of Chicago's largest independent lamp supplier. If any of your readers wish to buy Sylvania "Gro-Lux" and "Gro-Lux wide-spectrum" lamps or Westinghouse "Agro-lite" fluorescent lamps, they may be purchased from me at a discount of 50% off list price. Lamps are available in 18-inch, 24-inch, or 48-inch lengths. I prefer to sell the lamps in multiples of six; however, I will accommodate all orders. Merchandise is sent by UPS with standard C.O.D. and freight charges. Eight-foot lamps must be shipped by truck. We also carry the G.E. and Norelco equivalents to "Gro-lux" at the same prices. If any technical information is needed, or if I can be of service in relating my personal experience with CP grown under these types of lamps, I would be pleased to report. Anyone interested write to: R. W. Ramsden, National Electric Supply, 5311 North Kedzie Avenue, Chicago, Illinois 60625."

SHORT NOTES

PEST CONTROL IN CP

by Leo C. Song, Jr.
Dept. of Biology, California State University, Fullerton, CA 92634

In CPN 2(4):60, it was pointed out by the author that the application of Cygon 2E, a systemic pesticide (penetrates the plant, rendering it toxic for a time against biting and sucking pests), resulted in severe leaf deformation and apical growth disturbances in some species of Drosera (notably D. adelae, binata complex, brevifolia, capillaris, capensis, montana, and spathulata complex), Byblis liniflora, Pinguicula, and less severely in Sarracenia. This condition resulted in the death of severely affected plants, but in the case of those with roots that were able to produce adventitious shoots (D. adelae, binata complex, capensis, and to a certain extent D. aliciae and the other members of the spathulata complex) this condition re-appeared on the new growth each year even though the use of Cygon had been discontinued in the form of direct applications. Since we still had to use it to control pests on other plants, these species were exposed to varying concentrations of Cygon vapor and spray drift, especially those growing in the greenhouses.

The distortion seemed to disappear during the cooler parts of the year only to reappear when the weather warmed up, which coincided in many cases with the applications of Cygon 2E on surrounding plants. Even those plants that were seemingly exposed to vapors very briefly would become distorted and eventually succumb. It was decided at this point to suspend the growing and propagation of sensitive species--we would concentrate on the resistant species such as D. filiformis, both forms and the hybrid, Drosera burmanni, rotundifolia, X nagamoto, the pygmies and the tuberous types. Materials of sensitive species were distributed as seeds, leaf cuttings from asymptomatic plants, and even seedlings not previously exposed to Cygon, to several people in the local area, mainly Bob Hanrahan in Santa Ana

(Orange County, California) and Jeff Collier in the San Fernando Valley (Los Angeles County) who were at that time warned of the results of treatments with Cygon.

Things seemed to go well at first, but then these individuals began to notice the same problem appearing in these plants as well as their progeny. An entire terrarium was affected after the introduction of a single plant(Collier, personal communication). At that time, Jeff Collier sent a sample of the affected material to the L.A. County Agriculture Dept. They made a positive identification of Cyclamen mite (Speneotarsonenus pallidus) which can cause the same type of distortion in some plants--cyclamen and African violets. This would account for the apparent spreading of what we formerly had called the Cygon Disease.

Taking our cue from this, we sent samples from Bob's plants to the Orange County Agriculture Dept. The agriculture inspector on his twice-a-year rounds of our area had also seen the affected plants here at California State University, Fullerton, and he took a sample. They at first said it could be a type of growth hormone damage, such as inadvertent exposure to 2,4,D, but we said to look for mites also. A few weeks later, we got the same identification--Cyclamen mite.

At about this time, we decided to begin a regular program of fumigation of all our greenhouses with Plantfume 103*, generally sold in 3.5 oz. cans, which is sufficient to treat 10,000 cu. ft. It is a preparation of 0,0,0,0-tetraethyl dithiopyrophosphate, which is ignited and produces a penetrating white smoke. The gas is effective against many types of mites, aphids, and mealy bugs--which was our main reason since the gravid females in many cases leave the plants and lay eggs in crevices, under pots, etc., and even live inside the pitchers of Sarracenia. Scale in the soft stage is also controlled, this being a serious pest of Sarracenia and Nepenthes. Fumigation is ideal for treating these plants because of low residues, relatively short exposure times (overnight), the ability to penetrate inside pitchers, and to kill any target pests in the area.

At this point a word of caution. A use permit is required (at least in California) for this pesticide and a monthly report is required regardless of quantity used. This permit is issued by a county agricultural inspector provided that it will not endanger anything in the vicinity. It is best to check with your county inspector or the equivalent for more details.

We use the following method for fumigation in our greenhouses. Since the greenhouses are not airtight, the gas is able to diffuse out, thus reducing the killing power. We therefore use what amounts to about a triple dose of gas plus adequate air circulation by the use of fans and blowers to rapidly distribute the gas upon generation. This is done as soon as the sun is low enough so that the ventilation thermostats are not tripped. A 40-watt light bulb controlled by a timer is placed under the ventilation and heater thermostats. The timer is set to turn the bulb on for a few hours just before dawn which heats up both thermostats, turning on the coolers/vents and turning off the heat at the same time. The use of heat is recommended as this gas is most effective between 70-80° F./ 21-27° C. This process flushes the gas without the necessity of having to manually work the controls, thereby avoiding an exposure hazard.

The houses are fumigated on days on which we do not water as the foliage must be dry. This presented a problem since Drosera, Pinguicula, Byblis, and Drosophyllum, etc. are always "wet" and pitcher plants have water inside the pitchers. After a few test plants were placed in the greenhouses and exposed to the gas without apparent damage, our entire collection of plants, including seedlings, was treated. Plants that were in the lath house were put on carts and transported to the greenhouse for treatment. At least two and sometimes more treatments were given within a week of each other. Plants in the greenhouses have received subsequent treatments with only some foliar damage--edges slightly burned in some Sarracenia and Dionaea.

The results from the fumigation alone have been excellent. The Drosera species and Byblis liniflora affected with the cyclamen mite have shown signs of recovery with normal leaves and flowers being produced. Mealy bug has been eliminated or greatly reduced from the Sarracenia and there are no visible scale. An unknown Drosera, possibly D. madagascariensis, whose tip had been killed by the mite attack, has produced a new shoot. To further insure the control of the mite, all susceptible and affected plants have been treated upon recommendation of the Orange County Agriculture Dept. with Kelthane 35 WP, a very effective miticide, in a 35% wettable powder. We feel that the use of wettable powders is better than liquids since the organic solvents used to dissolve the active ingredients may cause most of the damage noted. Kelthane is used at about half the recommended dose (1.5 tbs/gal) for house plants, which works out to be about 2 tsp/gal (2tsp/4L). A wetting agent is also added, Basic H (a Shaklee product) being one of the safest at 1 tsp/gal water. Half this dose could be used if distilled water is used to avoid excessive foaming.

In conclusion, with respect to insect and other non-fungal, non-bacterial or non-viral pests, pest control in CP is pretty straightforward with many of the commercial preparations being useful at lower dosages. Cygon 2E will have to now be retested to make sure that the condition apparently caused by its application was caused by it alone or by a subsequent infection by cyclamen mite or both. Due to the resolution of this problem, we have resumed the growing and propagation of all sensitive species, and a research project that had to be suspended has now been resumed.

*Plantfume is manufactured for Plant Products Corp., Blue Point, Long Island, NY 11715

OBSERVATIONS ON BYBLIS GIGANTEA IN SOUTHWESTERN AUSTRALIA

by Larry DeBuhr

During a recent trip to southwestern Australia, I had the opportunity to see Byblis gigantea growing in the wild. I found the plants growing at two locations which were quite different in many respects, and I would like to describe these two areas and offer some observations about Byblis gigantea. Those interested might refer to the short note by J. A. Mazrimas in CPN IV, 30 (1975).

The first area where I found Byblis gigantea was the famed Cannington Swamp within the metropolitan area of Perth, Western Australia. The area has a low, flat topography and after the winter rains has very wet soil. The soil is composed primarily of white sand with a moderate amount of accumulated humus. Growing with B. gigantea were the common mud and sand flat species Polypompholyx multifida and Drosera menziesii and the less common Utricularia hookeri. The vegetation is low open scrub composed of small woody shrubs with some herbaceous species. Like most of southwestern Australia, the Cannington Swamp dries out during the hot dry summer. During this period B. gigantea dies back to its rootstock as described by Mazrimas in CPN IV, 30 (1975).

Naturally occurring fires are frequent in southwestern Australia, and part of this location had been burned several years before. Most of the plants in SW Australia are adapted to survive fires, and B. gigantea showed no apparent adverse effects from the fire. The species probably escapes the fire by means of the rootstock which is near or below the surface of the soil and out of reach of fires.

The importance of fires in SW Australia is further demonstrated by the fire-induced seed germinated as reported in CPN III, 33 (1974) and CPN IV, 30 (1975). Fires and/or repeated intense summer heat is probably responsible for induction of seed germination of B. gigantea in its natural habitat as well as in cultivation.

The second location where I saw B. gigantea was about 140 miles north of Perth and about 35 miles inland. This site was at the top of a well-drained hill with soil composed of a mixture of white sand soil and laterite pebbles. Laterite is reddish in color and contains large amounts of iron. Because of abundant spring rains, the soil was moist but not soggy. The vegetation was composed of very dense scrub composed of shrubs about 2-4 ft. tall and growing close together. According to several botanists in Western Australia, B. gigantea is actually more common in this general area than around Perth. At this locality there were more plants for a similarly-sized area than at Cannington Swamp. B. gigantea apparently has a wider tolerance to soil types, soil moisture, and habitat preference than is commonly believed.

Mazrimas mentioned in his short note that Byblis, because of its insectivorous nature, "is capable of growing in soil with low nitrogen content free from competition of other plants." This is an old concept that, as a generalization about all insectivorous plants, should be re-examined. The soil in SW Australia is, as a whole, very sterile, yet the vegetation is commonly quite dense with a large number of different species. Byblis gigantea is definitely not without competition from other plants. This is true of most of the Drosera species in Western Australia also. In SW Australia the density of the vegetation decreases with both extremes in soil moisture--with swamps and with deserts. It would appear that, at least in SW Australia, excessive soil moisture is more of a limiting factor for plant growth than is soil fertility. That is, more plants can tolerate the low soil fertility than can tolerate aquatic or semi-aquatic habitats.

An observation that may be of interest to some of the readers involves floral mimicry between the flowers of B. gigantea and the flowers of Thysanotus multiflorus, a member of the lily family that was found growing at both localities with B. gigantea. Floral mimicry between plants deals with the occurrence of similar floral structure and color in the flowers of two plants that grow together but are not related. The condition is a result of adaptations of both plants to the same pollinator. The flower of Thysanotus multiflorus is the same size and color as the flower of B. gigantea. Both species flower at the same time, and both have stamens located on one side of the flowers and twisted. Presumably both species are pollinated by the same insect.

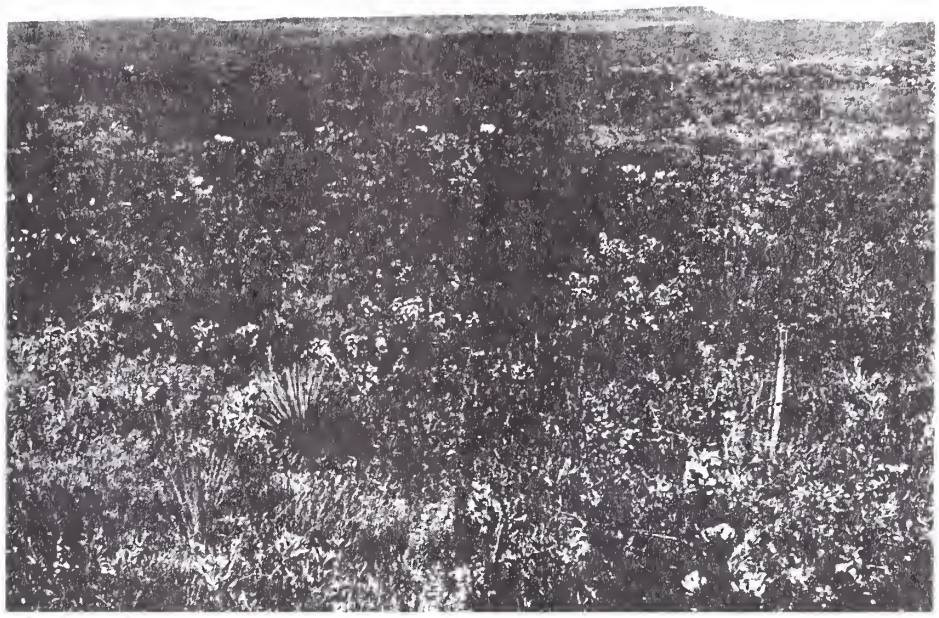
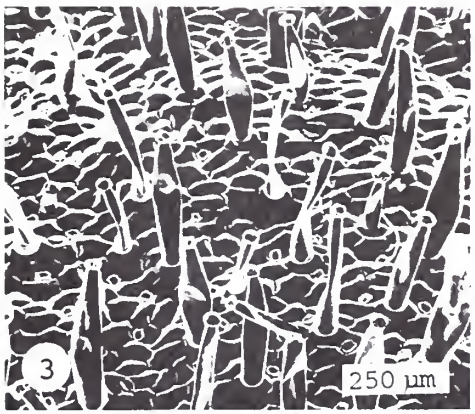


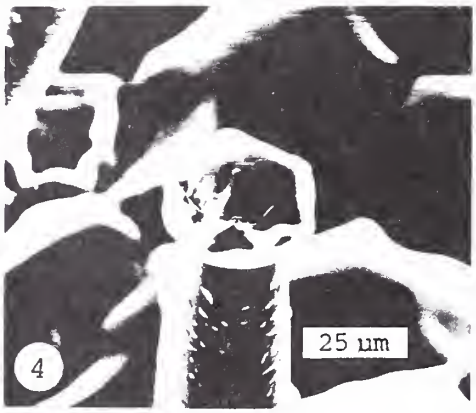
FIGURE 1: Habitat of Byblis gigantea in well drained laterite-sand hill about 140 mi. north of Perth, W. A.

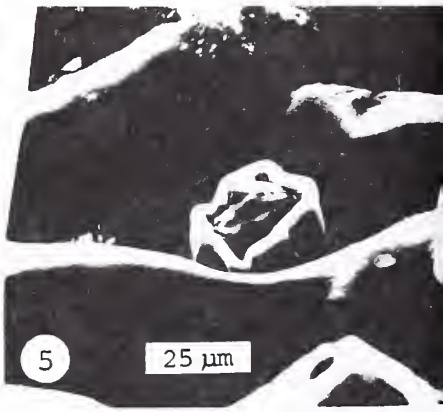
URE 2: Plant of B. gigantea growing in Cannington
mp.

FIGURE 3: Flower of B. gigantea. Note twisted stamens and style. The small white spots are grains of sand which get into most closeup pictures made in the field in Western Australia.

SEM OF PINGUICULA by Richard M. Adams II







It was reported by Mazrimas in CPN IV, 30 (1975) (see also CPN I, 38, 1972) that when the flower of B. gigantea is vibrated, pollen is released through pores at the tip of the anthers. Research has indicated that plants which conceal their pollen and later release the pollen through terminal pores do so in response to the vibrations of the wings of insects foraging for pollen. (See "Behavioral aspects of coadaptations between flowers and insect pollinators" by L. W. Macior in Ann. of the Missouri Botanical Gardens, 61 (3): 760-769, 1974)

These few field observations serve to illustrate the almost total lack of biological information about Byblis gigantea and the need for extensive field investigations. The ecology of B. gigantea is not thoroughly known, and extensive ecological and biological studies are indicated. Most carnivorous plants show biological phenomena, in addition to their carnivorous nature, which should be studied.

SEM OBSERVATIONS OF A BUTTERWORT

by Richard M. Adams, II, Department of Biological Sciences
Union College, Schenectady, New York

(The author gratefully acknowledges the SEM time and technical assistance granted by The Dudley Observatory, Albany, NY, particularly by Messrs. Douglas Hallgren, Tony Laudate, and Bill Radigan; and the critical review of the manuscript by Drs. George Smith and Peter Tobiessen, Union College.)

Pinguicula macrophylla Kunth (Lentibulariaceae), native to Central America, is a rosette-forming carnivorous plant of the "fly-paper" type (Fig. 1). Although the leaves appear to be nothing extraordinary by superficial examination, their upper surfaces are covered with innumerable glands of two types: Stalked glands secrete muscilage which attracts and holds insects, and sessile glands secrete a proteolytic enzyme which digests the insects so that they may be absorbed by the plant as a source of nutrients. These glands are invisible to the unaided eye, but the stalked glands appear as a fine pubescence and can be observed with a handlens (Fig. 2).

The purpose of this investigation was to observe the upper leaf surface with a scanning electron microscope (SEM), a machine made available circa 1967 and used for examining the surface features of specimens at a magnification range of from 20x to 100,000x with high resolution (up to 100A) and great depth of field.

Materials and Methods. A Pinguicula macrophylla plant collected in Guatemala was placed in a substrate consisting of 3:2:1 horticultural treefern: milled Sphagnum moss: perlite, and grown under fluorescent lights (30 cm. [12 in.] from two 40 watt Sylvania "Wide-Spectrum Gro-Lux" bulbs) at room temperature and approximately 80% relative humidity.

Leaves were excised and prepared by the method of Panessa and Gennaro,[3] (4 days in 5% glutaraldehyde fixative, overnight in 2% uranyl acetate post-fixative, 4 days in 50% glycerine), with the exception that absolute ethanol was substituted for water in the glycerine solution, to achieve further hardening of the tissue to reduce its distortion under vacuum.

The specimen was drained of excess solution on lint-free cloth, then affixed to an SEM stub which was coated with silver conductive paint and allowed to dry to tackiness before application of the tissue. A thin metal coating was vacuum applied before viewing on a Cambridge Instrument "Stereoscan" SEM.

Results and Discussion. Figure 3 is an overview of the leaf surface. The epidermal cells, reminiscent of jigsaw puzzle pieces, are visible, together with the stalked and sessile glands. The use of 50% glycerine in ethanol rather than in water promoted greater tissue hardening of the stalked glands resulting in significantly less distortion and collapse of the stalks, which was a significant technical problem with this species. There is still some tendency for the stalked glands to collapse, however. The stalks of this species are longer (averaging 0.30 mm) than those of other species examined (P. vulgaris, 0.08 mm;[3] P. grandiflora, 0.10 mm).[1]

Figures 4 and 5 are close-ups of a stalked and sessile gland, respectively. The "droplets" on the stalk (Fig. 4) are likely coating artifacts. They were not affected by direct electron bombardment, and are therefore not likely to be liquid. The ridge circumscribing the sessile glands (Figs. 3,5) is a feature not previously described in this genus.

In the 1940's Lloyd[2], using light microscopy, reported 16 cells per stalked gland and 8 per sessile gland of P. vulgaris. In SEM photographs by Panessa[3] (P. vulgaris), 4 cells per gland of each type are visible; similar photos by Heslop-Harrison[1] (P. grandiflora) corroborate those of Panessa for sessile glands, but secretions obscure the comparable surface of the stalked glands. In our study no multiple cells are definitely distinguishable on

either type gland. Comparative measurements of the glands using available photos of the three species[2,3] indicate the diameters of stalked and sessile glands of P. macrophylla are equal to the diameters of the individual cells of these glands in P. vulgaris and P. grandiflora. Possibly both stalked and sessile glands of P. macrophylla are unicellular, unless the greater tissue hardening achieved prevented delineation of cellular margins.

The readily demonstrated elongated stalks and the ridge-bordered sessile glands are helpful microscopic identification characteristics for differentiating the other two species from P. macrophylla, a species not previously examined with the SEM.

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Captions.

Fig. 1: Pinguicula macrophylla, plant actual size.
Fig. 2: Close-up of leaf (x3) with drops of muscilage and trapped insect visible.
Fig. 3: 56x overview of the upper leaf surface, showing stalked glands, sessile glands, and epidermal cells.
Fig. 4: 560x close-up of the tip (gland) of a stalked gland.
Fig. 5: 560x close-up of a sessile gland.

ARE CARNIVOROUS PLANTS CARNIVOROUS?

by Stephen E. Williams

There have been debates about whether carnivorous plants use nutrients from their prey. Partly as a result of this question, scientists have performed experiments and made field observations which have demonstrated that at least some species of carnivorous plants: 1. Capture prey (1); 2. Produce digestive enzymes which digest the prey (2,3); 3. Absorb the nutrients from the digested prey (4,5,6,7); 4. Transport the absorbed nutrients to the entire plant (5,7,8,); 5. When fed will grow faster, produce more flowers, seed and otherwise prosper more than unfed control plants (9,10,11).

But is the eating of meat sufficient grounds for calling anything (animal or plant) carnivorous? In the case of animals it is not. There are omnivores which we are told eat almost anything and certain herbivores such as squirrels are known to grab an insect or two, yet we do not call them carnivores because of this. Can we then call a plant carnivorous merely because it happens to digest an insect occasionally?

To fully answer this last question it is worthwhile going over a bit of information about nutrition. When we eat we gain three things: 1. Minerals - the elements that make up the various chemicals from which our bodies are made. 2. Essential organic compounds -such as certain vitamins and amino acids (digested proteins) which our body cannot make. 3. Energy- to power our movements and the synthetic processes that repair and build our body.

How do most plants get these three kinds of nutrients? They are autotrophic. That is, they take most of their minerals up through their roots, manufacture all their organic compounds themselves and trap the energy of sunlight by making carbon dioxide into sugar.

How do carnivorous plants get these kinds of nutrients? This is a more complex question. Drosera, Pinguicula and Utricularia plants have been grown in sterile conditions without feeding (11,12,13). Both Drosophyllum and Drosera have been directly demonstrated to be photosynthetic (14). Utricularia will not flower unless it is fed (12) but Pinguicula and Drosera will carry out all their normal functions in sterile culture on inorganic media (11,13). Drosera and Pinguicula which are grown on inorganic nutrients in sterile culture from seed to seed undoubtedly take their nutrition in the same way that most other plants do. But very few carnivorous plants grow inside sterile bottles and none do without the help of a dedicated human slave (usually a graduate student). Most carnivorous plants derive nutrition from both the animals they capture and the more typical plant nutritional modes. The question then becomes "How much nutrition comes from each source?" and the answer is "No one knows."

It seems likely--although it is unproven--that the vast majority of the energy and essential organic compounds of most carnivorous plants come from photosynthesis and other synthetic processes within the plant. It seems likely--and is equally unproven--that in nature the

majority of the minerals used by the plant come from the captured prey. Nearly all carnivorous plants grow in mineral-poor habitats(1) and it would certainly be of value for them to capture a mineral source.

If the conjectures above are correct, should we call carnivorous plants carnivorous? Certainly all animals to which the term applies gain almost all of their energy from the prey they capture and this would constitute an important difference between carnivorous plants and carnivorous animals.

Oddly enough, there are animal systems which seem parallel in their feeding habits to the carnivorous plants. Coral polyps with algae growing inside them grow in very mineral-poor waters with very little food to eat. It has been shown that the "carnivorous" behavior of the polyp captures an important source of minerals for itself and the algae but that the energy supply of both the polyp and algae is nearly all from the photosynthesis of the algae growing in and alongside the polyp (15). Is the polyp carnivorous? The ecologists who made this study decided it was both a carnivore and a herbivore (although it did not ingest the algae!). Perhaps we should consider carnivorous plants both carnivorous and autotrophic and avoid burdensome troubles such as having to change the name of this newsletter.

(Ed. note--We could engage in the German language habit of building impossible compound words and retitle CARNIVOROAUTOTROPHIC PLANT NEWSLETTER; or how about AUTOTROPHOCARNIVOROPHYTE NEWSLETTER? By the time a potentially interested subscriber would have decoded and analyzed it, he would have missed a year's subscription! And if you do not send in your renewal today, you may miss how all this turns out.)

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BACTERIOLOGICAL AND ECOLOGICAL OBSERVATIONS OF THE NORTHERN PITCHER PLANT, SARRACENIA PURPUREA L. Summary of thesis. John Lindquist

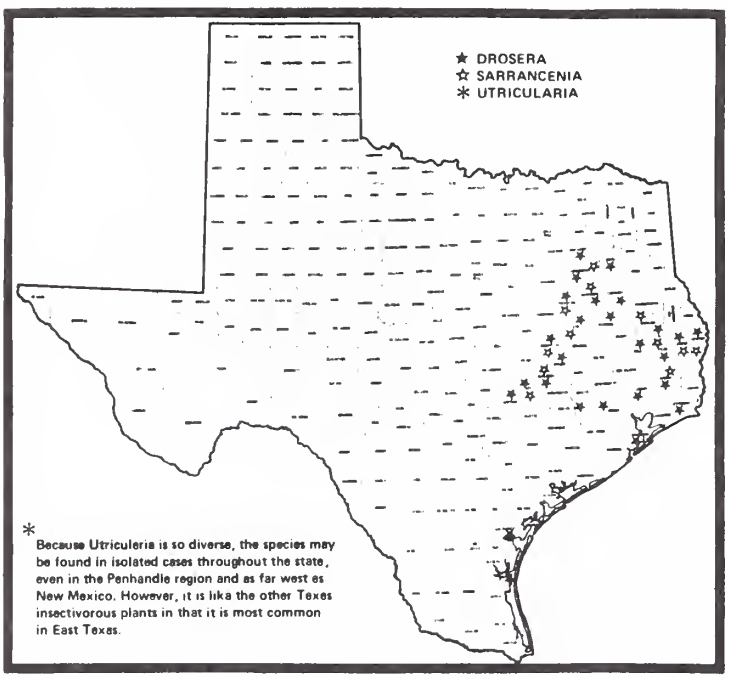
Studies were made on the pitcher plant, Sarracenia purpurea, growing in bogs near Cambridge and Drummond, Wisconsin. The well-known habit of the plant to supplement its nutritional needs by the entrapment of insects was observed.

The pH of the pitcher fluid of field plants ranged from 3.1 to 7.2, and carbon dioxide was considered an important factor in the acidity. The microbial flora of the pitcher fluid was generally typical of plant and aquatic habitats. Proteolytic and chitinolytic bacteria were isolated and included members of the genera Pseudomonas, Chromobacterium, Serratia, Aeromonas and Cytophaga. Digestion of insects was accompanied by increases in gram-negative and proteolytic bacteria, protease and ammonia, and the digestive process appeared to be largely mediated by the bacteria. Ammonia released by microbial deamination was considered an important source of nitrogen for the plant.

Photosynthetic bacteria, generally identified as Rhodopseudomonas acidophila, were found in each of the 22 leaves tested for these bacteria. Nitrogen-fixing bacteria, identified as Klebsiella pneumoniae and Citrobacter sp. were isolated from the pitcher fluid, but no nitrogen fixation was detected in the fluid when tested by the acetylene-reduction method. Other bacteria found in the pitcher fluid include Flavobacterium, Microcyclus, Clostridium, Streptococcus, Escherichia coli and a pectin-hydrolyzing strain of Enterobacter aerogenes. Yeasts, molds, algae, protozoa and rotifers were also observed.

CARNIVOROUS PLANTS OF TEXAS
by Grady Lucas

In Texas there are fifteen species of carnivorous plants representing four genera in three families. These genera are Sarracenia, Drosera, Utricularia, and Pinguicula, the latter found throughout the state. The greatest concentrations of CP species in the state are found in the east and southeast portions where the rainfall is greater and the soil more commonly retains water in such forms as bogs, seepages and savannahs. This generalization as to habitat does not necessarily include Utricularia which are found in fresh water throughout the state. However, Utricularia are more common in the eastern part of the state.



All Texas varieties of CP seem to be fairly hardy. In some areas CP have increased in population because of man-caused habitat changes. An example of such changes is an area where power lines are constructed and the digging near the seepages makes the soil "boggy". Sarracenia and Pinguicula are frequently found in these boggy areas.

The largest of the Texas CP is Sarracenia alata. This is the only species of Sarracenia native to Texas, and in the wild ranges from six to twenty-eight inches in height. In Texas Sarracenia alata blooms from April through May.

Next in the Texas delegation of CP is Drosera. The only species native to Texas is Drosera brevifolia. These plants are either perennial or biennial, and the flowers bloom from early February to late August. In late autumn and early winter the leaves turn deep red and are easy to spot against the dying vegetation.

Utricularia are probably the most common CP in the world. Of the 170 species in four genera, Texas has ten species occurring throughout the state. One of the largest known concentrations of Utricularia in the state is on Caddo Lake with five or six acres inhabited. Recent studies suggest that Utricularia occasionally trap duckweeds which would make them herbivorous as well as carnivorous.

Utricularia vary greatly in size and distribution over the state. Water conditions for one species in the eastern portion of the state probably would not sustain another variety from central Texas. In other words, specific habitat requirements such as oxygen content and minerals in the water must be met for the plant to survive. This is why soft acidic water in east Texas harbors different species than the relatively hard alkaline waters found in central Texas.

Of the thirty-five known species of Pinguicula, Texas has only one, Pinguicula pumila, which may be found in southeast Texas.

PRELIMINARY EXPERIMENTS ON THE EFFECTS OF PLANT HORMONES IN GERMINATION OF BYBLIS GIGANTEA SEEDS
by Donald Schnell

Regular readers of CPN are familiar with the difficulties involved in germinating seed of Byblis gigantea, and those who have tried it are often frustrated by irregular results. There is far less problem with the mainly annual B. liniflora. The difficulties with B. gigantea have been attributed to a short half-life viability after seedset, an unusually resistant seed coat, and exacting environmental requirements in its native habitat which have been insufficiently studied and therefore are not at all understood. Many novel techniques have been devised to prod recalcitrant seed into germination, most of these revolving around some sort of heat treatment and a great deal of patience as germination proceeds over a period of several months to a year or more. The rationale behind heat treatment has been that the moist and then drying sandy soil in Byblis areas heats up to rather high temperatures during certain seasons and this may play a key role in the plant's phenologic activities.

In an attempt to further study the process of seed germination in this species, we thought of substituting trial by hormone for trial by fire. The following experiments were carried out.

New 6 cm. white square plastic pots were thoroughly rinsed in hot tap water (non-chlorinated, conductance less than 40 mhos) and air dried. They were then filled to within 1 cm. of the top with a 50/50 mix of fine white washed quartz sand and Canadian peat (Premier brand). The mixture was wetted by pouring nearly boiling tapwater through the pots until the "soil" was well saturated. All pots were then completely cooled to ambient room temperature in the open air. Unwashed and untreated B. gigantea seed that was a year or more old* was then distributed over the surface of the growing mix, 20-25 evenly spaced seeds per pot. The seeds were not covered.

Next, the following hormone** mixtures were made up using distilled water and these were carefully watered through the mix until we felt the added solution was dripping through. We used medicine droppers in order not to disturb or cover the seeds with floating particles of planting mix. A control pot received distilled water only. The pot numbers and their respective hormone "cocktails" were (results in parentheses):

1. Control--(No germination in 61 days)
2. Yeast extract (Difco 0127-02, control 567058), 3 g/L--(No germination in 61 days)
3. Gibberellic acid (75% K salt), saturated aqueous sol. at 25 C--(60% germination in 9 days, none thereafter)
4. 1-Naphthylacetic acid, .024 mg/dl, and Thiamin, .045 mg/dl--(No germination in 61 days)
5. Gibberellic acid (75% K salt), sat. aqueous sol, at 25 C--(20% germination in 12 days)
6. Kinetin riboside, 10 mg/dl, and 1-Naphthylacetic acid, .024 mg/dl--(30% germination in 10 days)
7. Gibberellin A7, sat. aqueous sol. at 25 C--(20% germination in 11 days)
8. Gibberellin A7, sat. aqueous sol. at 25 C, Kinetin riboside, 10 mg/dl, 1-Naphthylacetic acid, .024 mg/dl--(85% germination in 8 days)
9. Kinetin riboside, 10 mg/dl--(No germination in 18 days)

The pots were placed in a glass-covered terrarium, above the floor so there would be no hormone runoff crossover from pot to pot. The terrarium setup was not watered any further and was placed under a 37 cm. wide 4x40 watt bank of Verilux^{c} tubes, these being 15 cm. from the seeds. Temperatures varied from 18-20 C at night to 26-27 C days and the photoperiod was 16 hours. The results of the experiments are listed above after the hormone formulations.

We can readily see that excessive heat was not a factor in germination successes, nor was some unknown factor from native soil present (unless serendipitously so in our mix!). We can also see that certain hormone mixtures, particularly pots 3, 6, and 8, were very effective in stimulating germination. Particularly, solubilized kinetin (riboside) and gibberellins seem to have a mutually potentiating effect. The auxin was of little help unless combined with a gibberellin, or a gibberellin and kinetin.

The germinating seeds exhibited a peculiar characteristic in that geotropism seemed to be lost and seedling roots sprouted up in every direction, mainly into the air, and successful rooting was tremendously diminished. Attempts to place the seeds upright resulted in eventual death of the seedling in 2-8 days anyway, possibly due to air drying, light damage or mechanical damage to brittle rootlings. Those seedlings that did germinate upright progressed to the 3-4 leaf stage and then damped off. (We did not interfere with this process since this would have entailed moving the pots to administer fungicides or risk getting same into other pots and thus bring an unknown into the experiment.) Since the seeds of this species are so small, we arbitrarily followed the precept of sowing them on the surface rather than covering them. In future experiments, we plan to cover the seeds with a thin layer of mix to see if this will encourage proper direction of the root and increase seedling survival. Also, future experiments will be required to exactly sort out which factors in the various "cocktails" were most important by making additional combinations and varying concentrations.

These experiments are, of course, too preliminary to draw conclusions with any finality at this point. However, we have managed to get germination in a relatively short period, with many seeds germinating at once rather than sequentially over a protracted period, using the hormone mixes above. We cannot even begin to hazard the opinion that this in some way mimics the natural process of germination in the plant's natural habitat. The complex interactions of heat on the seed coat and on various chemical processes within the seeds, enzymes and hormone co-reactions, inhibitions and stimulations, and water dynamics could all enter into the process of germination to varying degrees. Whether our seed treatments mimicked, bypassed or followed alternate pathways of the germination process cannot be decided at this time. Further work will await another supply of seed!

*We are grateful to Joe Mazrimas for a generous supply of seed.

**Obtained from ICN Life Sciences Group, Cleveland, Ohio.

THE SLOW DEATH OF SUITLAND BOG
by Robert Czerwony

All of those interested in conservation of wild carnivorous plant sites, and particularly those living in the Washington, D.C. area, will be sad to hear of the imminent destruction of yet another wild site--Suitland Bog in Maryland.

Two years ago I spent many summer weekends in Suitland Bog. The plants grew on a small spring-fed slope which drained into a larger swampy stream area and included Drosera intermedia, Drosera filiformis, and Sarracenia purpurea. Several fine specimens of Dionaea, descendants of a crop of fly-traps planted there five years earlier, were also to be found. Anyone who has experienced the wonder of visiting one of these sites knows what a precious, irreplaceable part of our natural resources they are, and can understand why I was disturbed to find just a short distance above the bog a large cleared area adjacent to an apartment complex, obviously waiting for some future expansion.

In August I drove to Washington for a few days and visited the bog again. It was much more difficult to find than it had been, and what was most disturbing to me was that the boundaries of the cleared area had been expanded; in several places roads had been cut directly across the main drainage of the swamp, and worst of all, an access road had been cleared through the very base of the swamp, accelerating drainage of the entire area. When at length I found the CP slope, the area supporting the plants had shrunk to less than half of what it had been. The Sarracenia population was nearly wiped out, the ground there having dried fully and been overgrown by the advancing trees, while the total number of Drosera was down to about a third of what I had previously observed. At the current rate of drainage, all the CP species would probably be gone in another two years even if left undisturbed. Most ominous was what appeared to be a surveying stake planted right at the foot of the slope. New areas on either side of the bog had been bulldozed and filled, auguring no good for the survival of the Suitland plants.

There is a way to save the plants, though nothing will help the bog itself. We needn't sit back and watch them get buried for the greater glory and profit of another apartment complex, for there is a nearby carnivorous plant-supporting bog in Cedarville State Forest, Maryland. It is close enough for three or four determined people to transplant the entire remaining CP population of Suitland Bog to the protection of the state forest which is patrolled by permanently-stationed rangers.

I am really unable to do much more (gas, tolls and meals to and from Cleveland is no small matter), though I did remove some excellent flowering Drosera which are all doing well. I would like to suggest that all those CP enthusiasts in the Washington, D.C. area take some action in this matter. Collect a small number, transplant the rest. It is far preferable to waiting for the bulldozer and cement trucks. If anyone interested does not know the exact location of the bog, write to me at 574-C Corkhill Rd. #319, Bedford, Ohio 44146, or call Dr. Schetler at the Smithsonian, who has visited the bog.

I will be working on propagating those plants I have collected and would rather have them raised and traded among knowledgeable CP collectors than simply watch them be razed for a parking lot. Over a year ago I purchased a dozen flytraps from a commercial grower, but will never need to again, for through bulb-splitting and leaf propagation I have over fifty healthy plants today and expect to have even greater success with the Drosera. It is a sad thought that in another fifty years these plants may have been exploited and eliminated out of most of their wild sites, and survive only in collections and protected areas, but that is better than going the way of the passenger pigeon.

I would be most interested to hear from anyone in the Washington, D.C. area regarding the plants or future of Suitland Bog.

MEASURING ACTION POTENTIALS IN DIONAEA
by Dave Dubosky

Recently I was working on an experiment involving potentials in Venus' flytraps and I thought some of my findings would be of interest to you.

One of my references (Joseph R. DiPalma, Robert Mohl, and William Best, Jr., "Action Potential and Contraction of Dionaea muscipula" Science, Vol. 133, March 24, 1961) that best explained things to me told me much, except how to and where to attach the electrodes to the plants (the electrodes are connected to an instrument that picks up electrical currents, or potentials, in the plants). After much experimentation, we discovered that the electrodes should be attached to the outside of the trap itself and not to the petiole as we had once thought. We connected the electrodes using "Glycerin and Rosewater", a hand lotion that not only is sticky enough to hold them to the plant, but gives good electrical contact. The electrodes themselves were made of aluminum foil, for they must be flexible in order to stay attached during the closing of the trap.

When everything was set up, I turned on the instrument and the audio oscillator (part of the instrument) emitted a constant sound, always at the same pitch. When the plant's electrical current changed, so would the pitch.

I touched a trichome once. The pitch went up, down, and leveled off. Now it sounded the same as it always did. I touched it again and it repeated the same oscillations as before; this time, however, the trap closed.

I tried this using a live insect in the trap, and I could hear two distinct touches of the trichomes and then the closing of the trap. For quite some time then the insect stood still. Then suddenly violent thrashing around was heard through the instrument. Repeatedly, the insect touched the trichomes. Little did the animal know he was only signalling the plant to close tighter.

SPECIAL NOTICES

CP PHOTOS FOR SALE--JOE ISLEY (Box 2774, Duke Hospital, Durham, NC 27710), in the interest of conserving CP, has become a photographer of them rather than a collector. His photos are quite good and some have been published. These are in color, on 3 1/2 x 5 inch bordered glossy paper, and the original slides were made with a Pentax camera. The prints are 35¢ apiece and are made up to order, so allow 3-6 weeks for delivery. Presently available are: Sarracenia flava, S. purpurea (venosa), S. leucophylla, Dionaea, Drosera intermedia, D. filiformis, and Pinguicula caerulea. All photos were made in the field or in the habitat gardens at the North Carolina Botanical Garden in Chapel Hill.

TREVOR KUCHEL is looking for seeds in large or small quantities of Sarracenias, especially the different forms of species (either home grown or preferably collected in the wild). Also, hybrid seed and homemade crossings are sought. Contact him at P.O. Box 110, Murray Bridge, S.A. 5253 Australia, and please state what seeds you have and approximate price.

JOE MAZRIMAS has received relatively few requests for Nepenthes cuttings for the spring of 1976. He thanks everyone for sending in a letter requesting the cuttings and their description on how they intend to root and grow them. This is one last chance for the year to acquire various species of this pitcher plant. There will be many cuttings to send. See the notice on page 51 of #3 CPN. He also has several copies of Randall Schwartz's book left for sale at $5.50 domestic and $5.75 for foreign orders postpaid. This is the last chance for acquiring this book at this low price.

RECENT LITERATURE

Affolter, J.M., Olivo, R.F.: Action Potentials in Venus' flytraps: Long-term observations following the capture of prey. Am. Midl. Nat. 93(2): 443-445. 1975.
A flexible length of silver wire was attached to a leaf with a mixture of electrode paste and glue. Action potentials were produced in closed flytraps after prey had been trapped and only if prey were still active. Continuous recordings could be made for fifteen hours or longer.

Carlquist, S.: Island Biology, Columbia University Press, 1974.
In this book Dr. Carlquist discusses in one of its chapters the adaptive radiation of plants in Western Australia. Among the plants mentioned are the tuberous Droseras and their adaptation to fire and dryness. Also, the vining types of Droseras such as Drosera heterophylla, one of the ten species, show adaptation with twining stems.

DeBuhr, L.E.: Phylogenetic relationships of the Sarraceniaceae. Taxon 24:297-306, 1975.
The author believes there is little evidence to support a taxonomic relationship of this family with Droseraceae and Nepentheaceae, and suggests that placement as a suborder of the Theales would be best.

Forsyth, A., Robertson, R.J.: "K" reproductive strategy and larval behavior of the pitcher plant sarcophagid fly, Blaesoxipha fletcheri. Can. J. Zool. 53(2): 174-179, 1975.
The number of S. purpurea leaves limits the density of the insect larvae so that only one larva per pitcher leaf utilizes the food present. As a result, few larvae are produced but they are very large so that it is suggested that this larva is a "K" strategist relative to other sarcophagid flies.

Hashmi S., Siddiqui, S.: Trichomes on the floral parts of Utricularia. Bangladesh J. Bot. 3(2): 67-72, 1974.
Ontogeny, structure and distribution of four new types of trichomes of taxonomic importance in U. bifida, minor, stellaris, dichotoma, and cornuta are described.

Ishizu, Hiroshi: Insectivorous Plants. Jour. of Medical Reports of Ohtsuka. No. 274, pp. 30-41, 1975. IN JAPANESE
This little review contains some three dozen color photos of various CP and a brief description of types and function of each one.

Laurence, T.E., Seabury, F.: A scanning electron microscopic study of the utricle trichomes in Utricularia biflora Lam. Bot Gaz. 136(1): 87-93, 1975.

The mature utricle (bladder) can be characterized as having four different types of trichomes ornamenting the following regions: the external surface, entrance, threshold and pavement epithelium, and the internal utricle surface. All were seen using the scanning electron microscope.

Osmond, C.B., Ziegler, H., Stichler, W., Trimborn, P.: Carbon Isotope discrimination in alpine succulent plants supposed to be capable of crassulacean acid metabolism. Oecologia (Berl.) 18(3): 209-218, 1975.

The authors found that Pinguicula alpina has a carbon dioxide metabolism more like the succulent plant, such as Sempervivum. This means that dark carbon dioxide fixation makes a larger contribution than the light reaction.

Steyermark, J.A., Smith, L.B.: A new Drosera from Venezuela. Rhodora 76:491-493, 1974.

Designated Drosera felix, this new species was found in the Geand Savanna. The plant is small ("can be covered by a quarter") and the peduncle is quite short.

Whitehead, T.: Predatory plants of Texas. Texas Parks and Wildlife Magazine 33:16-20, May, 1975. (Copies of magazine available from Texas Parks and Wildlife Department, John H. Reagan Bldg. Austin, Texas 78701.)

Good full color article mentioning the fifteen species of CP in Texas with excellent photos of four. County range map.

Miles, D. H. et al: Tumor inhibitors: Preliminary investigation of antitumor activity of Sarracenia flava. J. Pharm. Sci. 63:613-615. 1974.

Chloroform and aqueous extracts of S. flava roots (sic) showed antitumor activity against human epidermoid carcinoma of the nasopharynx in cell culture. Betulin was identified as one constituent responsible for this activity. There is also a brief review of folklore medicinal uses.

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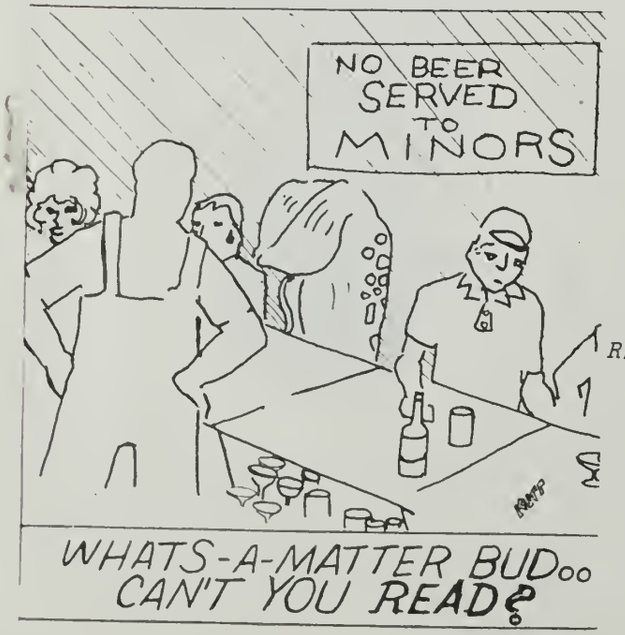
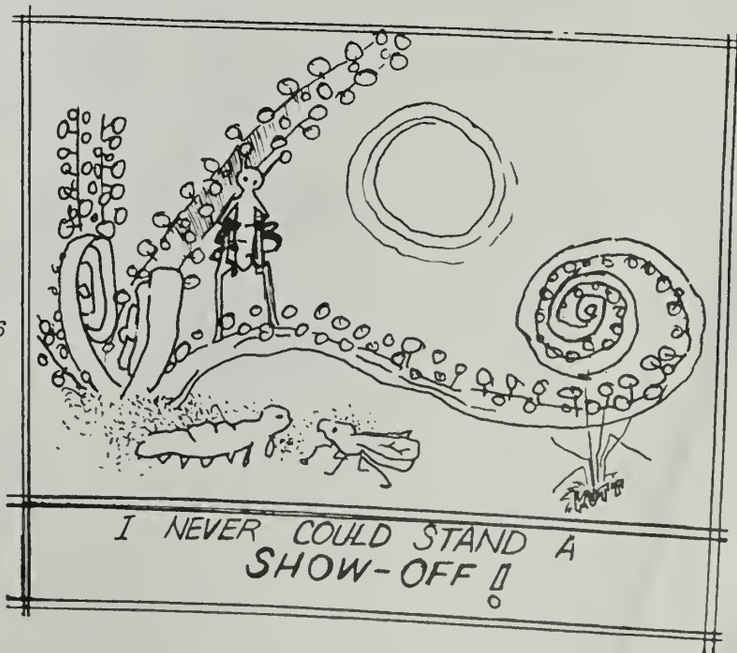


RENEW TODAY FOR 1976

FINAL NOTICE



Cartoons by DAVE KUTT